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The Condor

The California Condor. By Carl B. Koford. New York. 1953. National Audubon Society. 154 pages. Illustrated. $3.00.

This is the fourth Research Report in the series dealing with bird species that are dangerously reduced in numbers, the three previous reports having dealt with the ivory-billed woodpecker, the roseate spoonbill and the whooping crane. The National Audubon Society led the campaign to have designated as a sanctuary the area in California in which the last of these birds reside. The study of the condor by Dr. Koford, who is with the Museum of Vertebrate Zoology of the University of California, covers the life habits and current situation of the remaining birds. It is a significant ornithological contribution, particularly interesting in the light of the controversy aroused by the project to capture a pair of condors and attempt to preserve the species by breeding them in the San Diego Zoo. Lewis Wayne Walker, who has been assigned to make this capture, has contended that the birds cannot survive in the wild because their food supply has been seriously affected, and because of other factors. Dr. Koford feels that the birds can survive.

Bird Bulletin

Sixth Bulletin of the International Committee for Bird Preservation. New York. 1953. American Museum of Natural History. 248 pages. $1.90.

Published in English, French, German and Spanish, this issue of the Bulletin of the International Committee for Bird Preservation reports on the conference at Uppsala, Sweden, in 1950, presents a summary of the work of the Pan-American Section, reports on the conferences in London in 1947 and Paris in 1948, the Paris International Convention of 1950, and the International Wildfowl Research Institute. There are also reports by national sections.

Early Art

Art in the Ice Age. By Johannes Maringer and Hans-Georg Bandi. New York. 1953. Frederick A. Praeger. 168 pages. Illustrated in color and black and white. $12.50.

Recent research has filled in many gaps in our knowledge of prehistoric art and the art records that primitive man has left. The first conception upon which this book is based came from Professor Hugo Obermaier, authority on man's most ancient artistic productions. He, however, passed away in 1946, and the project was carried on by the present authors. Professor Obermaier planned to deal with the Franco-Cantabrian Ice-Age Art and with the Eastern Spanish rock picture cycle. To this the authors have added the Arctic Art of Scandinavia and northern Russia as being also a part of ice-age art. The book is beautifully illustrated.

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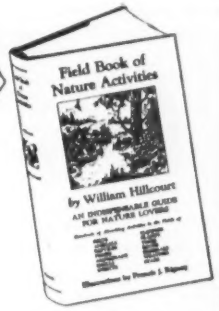

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Nature in Print

By HOWARD ZAHNISER

"INCESSANT is the curiosity of man, pressing is his interest in the external world," writes James Fisher in an "Epilogue" to his recently published great monograph on *The Fulmar*, which is itself a monument to man's incessant curiosity and pressing interest in his world. It is not only a fascinating interest in the fulmar, which this volume both serves and arouses, but also the human achievement in knowledge that it represents that gives it a special value. With scholarly thoroughness the large volume brings together the sum of our knowledge of this bird of the sea. In doing this it also testifies to the indefatigable zeal of its author in carrying forward the studies on which it has been based. Yet James Fisher has written the work, as he testifies in its last sentence, "not because I have thought it 'useful' to do so, but because I like fulmars and everything to do with them." It is this liking, of course, that makes the book so interesting and its reading an experience rather than merely the acquisition of knowledge.

The fulmar has probably been little known to most of us, a bird of the ocean and of cliffs and islands where seldom we have the chance to visit. It has provided a food supply for human beings on some of these islands—"on St. Kilda, in the Faeroes, and in Iceland"—and it has been so closely linked with human destiny as to make knowledge of the fulmar an introduction to the lives of the people on these islands. James Fisher's monograph on the bird is thus also a book of geography and exploration. Its great assembly of photographs provides a pictorial tour of the cliff coasts of many North Atlantic islands. "In search of knowledge about fulmars and their extension of range, James Fisher," say the editors of the New Naturalist Library in which this work appears, "has in the last eighteen years travelled nearly a quarter of a million miles, visiting Spitsbergen, Iceland, Norway, Rockall, and nearly every part of our own (British) coasts and outlying islands, and has digested over 2400 books, scientific papers, and articles."

Without parallel among wild species, comparable only to human experience, has been the increase in numbers of fulmars and their spectacular spread as a breeding species around the coasts of Britain's islands, and other north Atlantic countries, during the past two centuries. This increase and spread James Fisher has studied so thoroughly that the very thoroughness of his account becomes a fascination, as does his explanation. "It is my thesis," he writes, "that the fulmar's spread began when whaling increased the population of dead whales in the fulmar's area; that this whaling enabled the fulmars to make a real change in their feeding habits (but without starting something *entirely* new); and that, when whaling petered out, offshore trawling kept up a special food supply." Commenting again that "the more we learn about the controlling factors in birds' lives the more we discover them to be connected with food," he emphasizes "the conclusions that food has changed the fulmar, and man has changed the food."

Thus to a complete description of this bird, its habits, and the cycle of its life are added the interests of its relationships with human activities and destiny. And to all else is added the phenomenon of James Fisher (and other men) so earnestly studying another species of life, making *The Fulmar* indeed a work of rich value, not only to those especially interested in birds but also to many others.

Maurice Herzog's *Annapurna*, his tense account of the expedition that culminated in his and Louis Lachenal's ascent of the highest summit then known to have been reached by men since the Everest ascent, is in another way a testimony to our human determination to pursue all knowledge of our world—our incessant curiosity, our pressing interest, of which James Fisher wrote. Of a "savage and desolate cirque of mountains never before seen by man," Maurice Herzog wrote:

"No animal or plant could exist here. In the pure morning light this absence of all life, this utter destitution of nature, seemed only to intensify our own strength. How could we expect anyone else to understand the peculiar exhilaration that we drew from this barrenness, when man's natural tendency is to be attracted to everything in nature that is lush and fruitful?"

It may, indeed, seem all contrast to turn from *The Fulmar* to *Annapurna*. Yet I have been reading both these volumes on a cross-continent journey that again—as four years ago—finds me writing a "Nature in Print" in a streamlined train traveling through the valley of the upper Colorado, and it seems a rather fitting coincident that calls these two works to attention together—out of the several that are, of course, in my baggage. Perhaps it seems especially good to have them along on a long and lonesome journey because it has been a recent privilege at home, in Washington, D. C., to see and meet the two authors. It was for sure a rich pleasure to meet the British naturalist and explorer, James Fisher, along with Roger Peterson, on our own wild Plummers Island in the Potomac—and likewise to sit an evening in the Library of Congress chamber-music room to hear and see Maurice Herzog, on a journey from France, to see his slides and movies of the same Himalayan tests and triumphs that are chronicled in *Annapurna*, to shake a hand from which a price of triumph has been paid in amputations, but to see, nevertheless, the gleam of the victory in the eyes. But more likely the element common to both that brings them together in my mind is their evidence of supreme achievement of a goal reached through determined effort, this and the significance it carries of human nobility—the dauntlessness of mountain climbers, the persistent and noble thoroughness of the seeker for knowledge and understanding of the fulmar—and this realized in close touch with the wild world of Nature.

Maurice Herzog's book is a gripping and tense narrative, an adventure quest indeed. How close he was to failure, but for his courage and skill, again and again. Listen! "When I reached the top of the avalanche cone, I stretched out my axe as high up as I could to drive it into the slope. There was a dull sound—the avalanche! I swung my axe and it stuck in—I was saved; with some difficulty I pulled myself up on it out of the snow which was sliding down everywhere and swishing between my legs." How essential to the triumph that did come was also the devoted cooperation of all the expedition, and how well the complete account is inscribed in this book!

"I conceived it to be my duty, "wrote Maurice Herzog in his own foreword, "to give a plain truthful account of what happened, and have tried—so far as lay within my powers—to bring out its human aspect, and convey the extraordinary emotional atmosphere in which everything took place."

His success is as notable as this his aim, for a simple

The Net

By JOHN GALLINARI WHIDDING

God made a seine of stars all woven tight
Foreseeing man's conception from the dust
Of this small planet's slowly cooling crust,
And cast the plaited strands of crystal light
Into the depths that border heaven's height. . .
A thoughtful Fisher, tolerant and just,
His twinkling mesh securely knit with trust
Still shimmers in the ocean of the night.

The world, with man upon its stony shell,
Goes swimming through the universal deep
Inside the shining net that guards it well,
Held by a Hand that wavers not with sleep
Nor yet sees fit to trap with drawing string
So brave a catch, so venturesome a thing.

and straightforward narrative that makes its events and situations clear is at the same time charged with excitement and suffused with an ecstasy of happiness, even in pain.

The achievement was superb. Its telling is fitting and proper.

"The story of the climbing of Annapurna is a remarkable one, "wrote Eric Shipton in the book's introduction; "in some respects it is unique. . . .The expedition had not only to find a practicable route to the summit; they had first to find a way of reaching the mountain. It is this triple accomplishment of successful exploration, reconnaissance and assault, all within the brief season between the melting of the winter snows and the onset of the monsoon, that places the achievement of the French expedition in a class by itself, and has won our wholehearted admiration and applause."

Lucien Devies, Président du Comité de l'Himalaya et de la Fédération Francaise de la Montagne, in a preface to this volume appraises the significance of the achievement thus:

"That wonderful world of high mountains, dazzling in their rock and ice, acts as a catalyst. It suggests the infinite, but it is not the infinite. The heights only give us what we ourselves bring to them. Climbing is a means of self-expression. Its justification lies in the men it develops, its heroes and its saint. This was the essential truth which a whole nation grasped when it offered its praise and admiration to the conquerors of Annapurna. Man overcomes himself, affirms himself, and realizes himself in the struggle towards the summit, toward the absolute. In the extreme tension of the struggle, on the frontier of death, the universe disappears and drops away beneath us. Space, time, fear, suffering no longer exist. Everything then becomes quite simple. As on the crest of a wave, or in the heart of a cyclone, we are strangely calm—not the calm of emptiness, but the heart of action itself. Then we know with absolute certainty that there is something indestructible in us, against which nothing shall prevail."

But Maurice Herzog has himself most eloquently appraised the experience he so deeply knew.

In his foreword he writes:

"In overstepping our limitations, in touching the extreme boundaries of man's world, we have come to know something of its true splendor. In my worst moments of anguish, I seemed to discover the deep significance of existence of which till then I had been unaware. I saw that it was better to be true than to be strong."

And in the next-to-the-last paragraphs of his great book he writes:

"One always talks of the ideal as a goal towards which one strives but which one never reaches. For every one of us, Annapurna was an ideal that had been realized. In our youth we had not been misled by fantasies, nor by the bloody battles of modern warfare which feed the imagination of the young. For us the mountains had been a natural field of activity where, playing on the frontiers of life and death, we had found the freedom for which we were blindly groping and which was as necessary to us as bread. The mountains had bestowed on us their beauties, and we adored them with a child's simplicity and revered them with a monk's veneration of the divine.

"Annapurna, to which we had gone emptyhanded, was a treasure on which we should live the rest of our days. With this realization we turn the page: a new life begins."

Then in the volume's final paragraph, complete in one sentence, Maurice Herzog assures us:

"There are other Annapurnas in the lives of men."

Annapurna: First Conquest of An 8000-Meter Peak (26,493 Feet). By Maurice Herzog, Leader of the French Himalayan Expedition. Translated from the French by Nea Morin and Janet Adam Smith. Cartographic and Photographic Documentation by Marcel Ichac. New York: E. P. Dutton & Co. Inc. 1953. 316 pp. with introduction by Eric Shipton, preface by Lucien Devies, glossary, 3 photographs and a sketch map of the Dhaulagiri and Annapurna Massifs in color-gravure, 28 photographs on 25 plates in monochrome-gravure, and 8 text maps. $5.

The Fulmar. By James Fisher. London: Collins. Distributed in U. S. A. by John de Graff, Inc. 64 West 23rd St., New York 10, N. Y. 1952. xv + 496 pp. with reproduction in color of a painting by Peter Scott, 4 photographs in color on 3 plates, 78 photographs in halftones on 48 plates, 13 text drawings, 15 diagrams, 34 maps, preface by the editors of the New Naturalist Library, references, indexes of mammals, birds, and "selected places," and 8 appendices: Sedna and the Fulmar, an Eskimo Legend; scientific names; measurements; number of occupied nest-sites in 1949 on Westmann Isles; recovery of marked fulmars; statistics of fulmars taken in Iceland; "A Shetland Fulmar Population," by L. S. V. Venables; and comment on "The Palatability of the Fulmar and Its Egg." $7.

For Vacationers

Vacation Guide. Chicago. 1953. Rand NcNally and Company and the National Recreation Association. 128 pages. Illustrated with pictures and maps. $1.50.

This is a streamlined guide to vacationing in the United States, with suggested transcontinental tours and with descriptions of places to visit. Sources of additional information are provided. This is a most useful publication for the automobile traveler.

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Last Mammoth

The Last Mammoth. By Manly Wade Wellman. New York. 1953. Holiday House. 22 pages. Illustrated by Leej Ames. $2.50.

This is a fiction story based upon a report of a living mammoth that reached a frontier settlement in Carolina and sent a local meat-hunter on a successful search for the animal. It is an interesting story of pioneer days, although the generality of scientists hold that the mammoth disappeared from the scene before the white man arrived.

Jungle Adventure

High Jungles and Low. By Archie Carr. Gainesville, Florida. 1953. University of Florida Press. 226 pages. Illustrated. $4.50.

Several years were spent by the author, a young and perceptive naturalist, in the high interior jungles of Honduras and the low rain forest jungles of Nicaragua. Traveling by pickup truck and horseback, the author penetrated the remote fastnesses of both countries and came to know both its resources of Nature and its people. He writes about both entertainingly and has given us a book that is delightful to read.

Natural History

Natural History. Edited by Charles Tate Regan. New York. 1953. John de Graff, Inc. 896 pages. Illustrated. $10.00.

Although it is not indicated, this appears to be a new printing of this general work on natural history. Our library contains an earlier printing, which does not appear to differ, as to text or illustration, from this present book. Neither volume contains a date of issue, but there has been a shift in publisher in Great Britain and distributor in the United States. This is a good general work on natural history around the world.

Cats and Aquariums

Aquariums. By Anthony Evans. *The Care of Cats.* By Kit Wilson. New York. 1953. Dover Publications. Paperbound, $.60; clothbound, $1.50.

These are two practical little pocket books, one giving advice on the setting up, stocking and care of the home aquarium, the other dealing, as the title indicates, with the care of cats.

Math

Mathematical Recreations. By Maurice Kraitchik. New York. 1953. Dover Publications. 330 pages. $1.60 paperbound; $3.00 clothbound.

Anything mathematical frightens us, equations giving us goose-pimples and geometric problems leaving us ill. So we stand in complete awe of anyone who can understand what this little book for the mathematically minded proposes by way of recreation.

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The role of plant breeders
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Fishery Science

Fishery Science: Its Methods and Applications. By George A. Rounsefell and W. Harry Everhart. New York. 1953. John Wiley and Sons. 444 pages. Illustrated. $7.50.

Fishery management has made marked progress in recent years as research has contributed to the fund of knowledge of the dynamics of fish populations and their reactions to varying environments and conditions. Both habitat and human exploitation are important factors, and the fishery scientist of today is far better equipped than he was earlier in meeting the problem of maintaining and increasing the fishery resource. In this book the authors, both fishery biologists of wide experience, have provided a much-needed text for the administrator, research worker and student. They have brought together otherwise widely scattered information and have filled a gap in conservation literature.

Trees

Trees and Their Story. By Dorothy Sterling. New York. 1953. Doubleday and Company. 118 pages. Photographs by Myron Ehrenberg. $2.50.

This is an excellent introduction to trees and their story, with simple and popular text and fine photographs making a fine educational team. It is not an identification text but a readable tree book for the younger reader, although not the quite young.

Briefly Noted

Short Dictionary of Mythology. By P. G. Woodcock. New York. 1953. The Philosophical Library. 156 pages. $3.75. A dictionary for the general reader and one that should be specially valuable for school libraries.

Origin of Life. By A. I. Oparin. New York. 1953. Dover Publications. 270 pages. Paper, $1.70; cloth, $3.00. A new edition.

World in the Making. By James Avery Joyce. New York. 1953. Henry Schuman. 159 pages. Illustrated. $3.50. This is the story of international cooperation.

Hunting, Fishing and Camping. By L. L. Bean. Freeport, Maine. 10th Printing, 1952. L. L. Bean. 106 pages Illustrated. $1.00. Outdoors in Maine and how to enjoy yourself there.

Soviet Science. Arranged by Conway Zirkle and Howard A. Meyerhoff. Edited by Ruth C. Christman. Washington, D. C. 1952. American Association for the Advancement of Science. 108 pages. A symposium presented at the Philadelphia (1951) meeting of the A.A.A.S.

The True Book of Honeybees. By John Lewellen. Chicago. 1953. Childrens Press. Illustrated by Patricia Jackson. $2.00. Life in the hive written for the grade three level.

The True Book of Animals of Small Pond. By Phoebe Erickson. Chicago. 1953. Childrens Press. Illustrated by the author. $2.00. Written for youngsters of the second and third grade level.

The Conception of Disease. By Walther Riese, M. D. New York. 1953. The Philosophical Library. 120 pages. $3.75. The history, versions and nature of attitudes toward disease.

Atoms, Men and God. By Paul E. Sabine. New York. 1953. The Philosophical Library. 226 pages. $3.75. Stimulating discussion of relationships between religion and science.

Southern Flowers

Flowers of the South. By Wilhelmina F. Greene and Hugo L. Blomquist. Chapel Hill, N.C. 1953. University of North Carolina Press. 208 pages. Illustrated in color and black and white. $5.00.

Divided into two parts, this book treats first with the native wild flowers and then with the exotic varieties that have been introduced for ornamental use. More than five hundred flowers are described and pictured with pen and ink drawings, and 50 color plates cover some three hundred additional flowers. The treatment is popular and for use by the layman. End maps cover the exotics by providing a zonal distribution to indicate where and how, coast to coast, these plants may be grown. This book fills a gap in popular botanical literature.

Meeting the Atom

Total Atomic Defense. By Sylvian G. Kindall. West Rindge, N.H. 1953. Richard R. Smith Publisher, Inc. 224 pages. $3.00.

This is an interesting, important and often frightening discussion of defense against the atom bomb. Two particularly interesting chapters deal with what all-out war might mean to the wheat lands of the West and to our forest resources. It is pointed out that incendiary parchment, a development of World War II, would no doubt be dropped with devastating results to these two resources. This weapon falls to earth, withholding its spurt of flame until it can ignite a wheat field, or can send flames through great areas of forest. The author urges the enlistment of the beaver as one of those important in defense against such attack.

Government Books

A Popular Guide to Government Publications. By W. Philip Leidy. New York. 1953. Columbia University Press. 296 pages. $3.00.

Of course, the Government of the United States is the world's largest publisher, and many of its publications have become standard works, even, perhaps, classics of a sort. In this useful book the author classifies and lists some 2500 titles of government publications of widest appeal and greatest practical value. Brief descriptions accompany each listing. This is a book that should be in every public reference library. It should be called to the attention of every teacher who turns her youngsters loose with the mere admonition that they should write somewhere and get some information on the subject she may happen to have assigned. Reference to this book would certainly save us an immense amount of time and postage.

For Poets

First Aid for Limping Verse. By Madeleine Fouchaux. North Hollywood, Cal. 1953. The Camas Press, P.O. Box 3857, Victory Center Station. $.35.

This little booklet is designed to aid the poet to a better understanding of the basic mechanics of poetry. It does so in a clever and effective way. It occurs to us that it would be most helpful in English classes in schools where the students try their hand at poetry. The author does a great favor to the poet who is bothered by troubled feet, restless rhymes, or whose versification requires vitamin shots. We review this little booklet here because more than four thousand poems come to us every year, from which we select the sixty or so for which we have space.

First Fish

First Fish: What You Should Know to Catch Him. By C. B. Colby. New York. 1953. Coward-McCann, Inc. 48 pages. Illustrated by the author. $2.00.

This is the best book on fishing, for children, that at least one fifteen-year-old reader has yet seen. There are 100 very simple and informative drawings and sketches to explain every phase of fresh water fishing. This is all made simple for the youngster going out after his, or her, first fish. It not only tells where to fish, but it tells how to fish, what tackle to use, and gives a vivid description of the various types of fish. After the young fisherman has caught the first fish he, or she, can get information, from this book, on making a plaster cast or a silhouette of the fish. Included in the back of the book are a fisherman's dictionary and safety rules for fishing.M.Z.

The Moon

The Moon. By George Gamow. New York. 1953. Henry Schuman. 118 pages. Illustrated. $2.50.

With man casting eyes upon the moon as an early destination for his inter-stellar travels, it behooves us to "read up" on this chill companion of our nearer heavens. This entertaining book enables one to do so with both pleasure and informational profit. The author has chosen to introduce us to the moon by first reprinting, in French and English, Rostand's "Mock Serenade to the Moon." Then he gets right down to business and we learn about the moon in preparation for the final chapter, which goes into projected travel to our lunar friend, 240,000 miles away, which may not be so far, after all.

Contents Noted

THAT hunting is a dangerous pastime is annually indicated by the statistics of killed and wounded nimrods. This is now accented by the announcement by a Philadelphia manufacturer, called Armor Specialties Corporation, of an armored vest for gunners. The producer says: "Protective plates are laminated of fibre glass and other plastic components, set in individual pockets, slightly overlapping so that there are no spaces for penetration. Many layers of ballistic nylon protect the shoulders and zipper closure. Actual ballistic field tests have proven how superbly the hunting vest resists bullets."

STRANGE things are often done in the name of conservation. One such is a supposed conservation project of a Future Farmers of America group in Montgomery County, Ohio. Unfortunately it is an activity that is typical of misguided and uninformed programs too often laid out for FFA and 4-H Club groups. This Ohio project is described as a "pest control drive," the object of which is to kill crows, English sparrows and starlings. The boys are urged to shoot these birds, remove the heads and turn them in to obtain point credits for "vermin" killed. All three of these proscribed birds are eager insect eaters, even though they often may be nuisances. However, the serious fault and real danger in drives of this sort lies in the destruction of other and highly valuable birds. The young pest controller shoots at anything. One of them turned in twenty-five bird heads for credit. Eleven were of English sparrows; four were of bronzed grackles; six of song sparrows; one field sparrow; one white-throated sparrow and two slate-colored juncos. Thus whoever thought up this inexcusable project is responsible for the killing of fourteen protected birds out of a bag of twenty-five, and for having made a boy a lawbreaker.

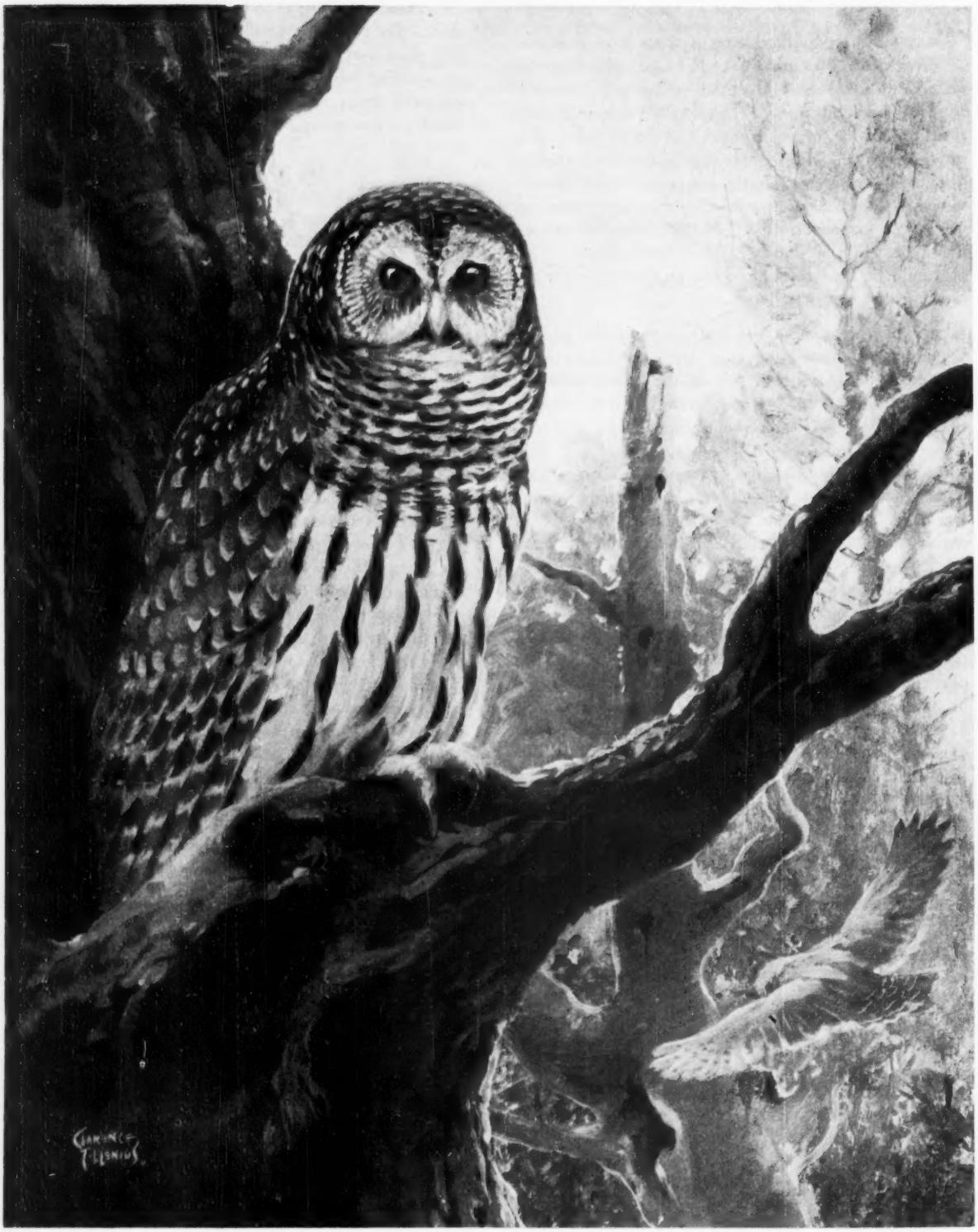
IT IS, of course, not too surprising that such a FFA project should turn up in Ohio, where a considerable percentage of the gunners are still living in the dark ages so far as conservation is concerned. Evidence of this is a recent demand that all hawks and owls be put on the vermin list and a bounty be paid for killing them. All hawks except the sharp-shinned, goshawk and pigeon hawk, and all owls except the great horned owl are protected by Ohio by action of the State authorities. Now, despite the conclusive evidence that already exists with respect to hawk and owl habits, and which proves them to be beneficial in controlling rodents and not detrimental to bird life, the gunners are seeking a scapegoat. They have pressured the State wildlife authorities into a series of experiments on "predator control" that are a waste of time and money.

ANOTHER one from Ohio—this time Bluffton. It seems that last year, when the fishing season opened, the members of the local sportsman's club found a loon on their private waters, helping himself to fish, thus becoming an interloper with no membership card. The loon was finally caught on an angler's line and done away with. This year a little coot showed up opening day. It enjoyed itself diving and taking minnows from the fishermen's lines. This was too much for one group of anglers, so they stoned the bird to death.

NEAR the village of East Millstone, New Jersey, stands Mettler's Woods, sixty-five acres of forest primeval. In 1703, when the ancestors of the late Thomas Mettler came to Somerset County, New Jersey, they cleared a considerable acreage of their land, but left this woods intact. It has remained untouched by generation after generation. About twenty-three years ago Rutgers University was granted permission to make studies there. The college botanists and others found this virgin forest to be a place where it was possible to observe the full life cycle growth of trees, where one could find topsoil more than three feet deep, giant oaks nearly three centuries old and plant and animal associations of outstanding biological value. Such a spot as Mettler's Woods has scientific importance that cannot be expressed in terms of money. However, standing timber does have a price tag, and commercial interests are eager to buy Mettler's Woods, cut it clean and strip it of its topsoil. Scientists, fully realizing the scientific tragedy that would result, are launching a drive to raise funds to purchase the forest, and to put it under the protection and administration of the botany department at Rutgers. Let us hope that this effort will be successful.

UNDER the terms of H.R. 5215, introduced by Congressman Dingell, the Internal Revenue Code would be amended by providing that any admissions to a wildlife sanctuary would be exempt from the admissions tax, provided that no part of the net earnings thereof inures to the benefit of any private stockholder or individual. We know of no wildlife sanctuary that is operated as a commercial venture. Those that do charge admission do so primarily to exercise control over individuals admitted and to derive some maintenance revenue. Most sanctuaries of this sort are mainly supported by contributions of interested individuals. There is the classic case of the late Lockhart Gaddy in North Carolina. A farm fish pond that Mr. Gaddy built so his mother-in-law would have fishing nearby, became a wintering place for several thousand Canada geese. As the birds increased in number, and the cost of feeding them became a serious drain, Mr. Gaddy charged a nominal fee to provide money for grain. He made no charge for school children, who did, however, register as visitors. Internal Revenue demanded back taxes for every one of these. Mr. Dingell's bill would prevent any similar inequities. Loss of revenue would be minor.

—R.W.W.

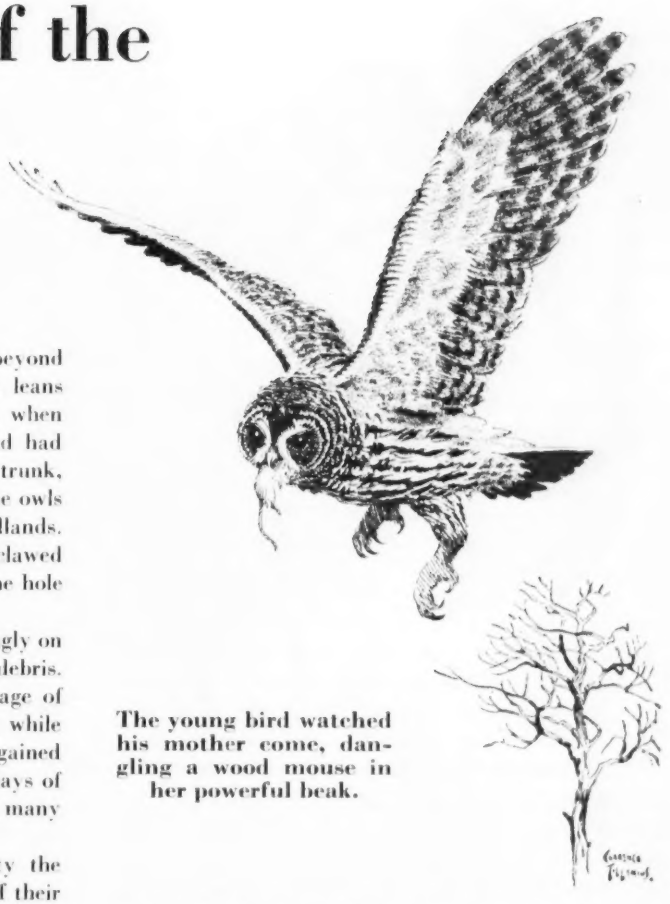


A decade before old Strix and his mate had been yearlings, and had first discovered the cavity high in the great tree trunk.

Barred Owls of the River's Bend

By A. MARGUERITE BAUMGARTNER

Illustrated by Clarence Tillenius



The young bird watched his mother come, dangling a wood mouse in her powerful beak.

WHERE the White River bends abruptly beyond the covered bridge a giant sycamore leans over the lazy stream. A decade ago, when old Strix and his mate had been yearlings, and had first discovered the cavity high in the great tree trunk, it had been a shallow depression out of which the owls could watch the teeming life of the Indiana woodlands. But now the scratchings of twenty-odd pairs of clawed feet and the rains of many seasons had rotted the hole deep into the vitals of the old tree.

There were three of them this year, nestled snugly on the bed of soft chips and scattered feathers and debris. They were safe while their fluffy juvenal plumage of buff and bars pushed out over growing muscles, while stubby wings lengthened and yellow legs gained strength. When they were a month old, their days of snug security were numbered. Disaster comes in many forms to children of the wilds.

As the gloom deepened in the nesting cavity the little barred owls began to stir restlessly. Far off their keen ears caught a low hooting—"Ho-ho-ho-to-hoo-ah"—so soft as to be almost felt rather than heard. Eagerly young Strix dug sharp claws into the sides of the nesting cavity.

At the entrance he met his mother, dangling a wood mouse in her powerful beak. She was beautiful in the last violet light of the May evening, a large gray owl barred with soft browns and buffs and whites, her round moon face with mild black eyes and her yellow beak encircled in a manifold frame of alternate brown and white. Deftly she tore bits of meat and stuffed them into the youngster's gaping bill. Then, all too soon, she spread her spacious wings and glided noiselessly away through the interlacing branches of the sycamores.

Young Strix watched her flight, buoyant and graceful, silent as the coming of dusk. Experimentally he spread his own small wings; foolhardy owlet, adventuresome before his time! He teetered dizzily on the rim of the nesting hole, swayed, flapped in a last frantic effort to regain his balance, and toppled headlong down the smooth trunk of the old tree. Sickeningly the branches rushed up at him, space sucked him downward, until he crashed in a crotch ten feet below the nest. Ten feet; more than ten times his own length, on a windswept perch with nothing to shield his downy head and palpitating breast.

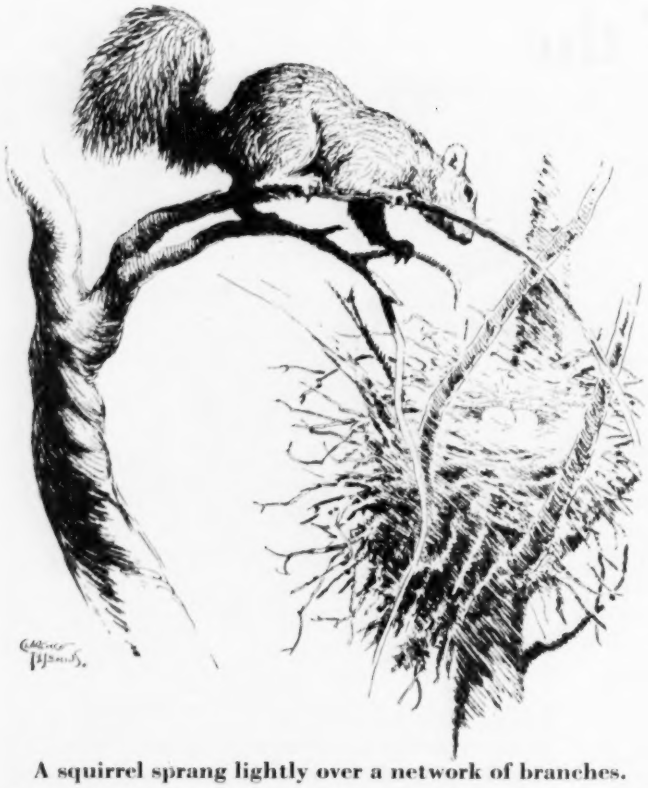
His squeaks of terror brought no response. Clawing madly, digging sharp little claws into the soft bark, peeping dismally, he finally worked his way back up the trunk and tumbled breathlessly into the nest. He was safe again, for a while.

But such is the nature of young things that security is not enough, and it was not long before young Strix was again clawing his way up the hollow trunk. Trembling from the exertion, wide-eyed with curiosity, he perched at the edge of the hole and looked upon the loveliness of his world.

It was dawn, and the woods were alive with the returning spring. Through the green tracery of elms and sycamores flitted myriad tiny warblers. Far below a pair of phoebes discussed their new home beneath the covered bridge. On the wooded slopes the white-winged moths hung over a carpet of trilliums, and clumps of Indian pipes reared graceful, ghostly heads from the shadow of a fallen log.

Now, at last, the younger sisters, too, were lured from the nest, and the old hole was empty until another spring. Thus their life in the outside world began, full of wonder, fraught with danger.

It was on a stormy night in late June that young Strix found himself at the end of a limb leaning into the wind. Now his mother sailed past him with a snake dangling tantalizingly from her beak. Eagerly young Strix stretched forward, and floundered into the empty



A squirrel sprang lightly over a network of branches.

air. Wildly the long wings beat, straining young muscles, as he felt himself dropping—down—down. And then, like a sudden bright flash of lightning, young Strix knew that he could fly. His wings were lifting and lowering, rhythmic and sure. He was sailing *out*, beyond the old sycamore, to the elms that overhung the covered bridge. Panting, he came down at last in a low branch and squeaked beseechingly for food. Then, weary from his first flight, he hunched down upon his perch and his mother could lure him no farther.

But young Strix had made an unfortunate choice of a roost. Down the road that sultry morning stalked a gangling youth with trigger finger all too heavy on a shiny new gun. Perhaps he would have passed the young owl unaware had not the phoebes sounded the alarm. Discovering the owlet not fifty feet from their nest, they flurried in excited circles about his inoffensive head. Their sharp, indignant cheeps soon brought the usual troop of small birds to the scene.

The boy stopped and watched their antics until he, too, could distinguish the camouflaged young owl, shaggy and still as a mossy stub against the gray bark of the elm. An owl—fair target for any gunner! Hastily the boy took aim.

Young Strix catapulted to the ground, a searing pain in the tip of his left wing, a dozen of the proud new wing feathers broken at mid-shaft. Half dead with fright he rolled down the slope and into a crevice beneath the covered bridge. The boy sauntered on, well satisfied with his gun and himself; unconcerned for the maimed body his careless aim had caused.

It was long after dark before the young owl dared venture out of his retreat. The pain was gone from his wing, although the last joint slanted dizzily and the broken feathers waved in useless ribbons in the breeze. Young Strix gave a hoarse squeak, but his parents were busy with the little sisters back at the old sycamore. Remembering his successful flight of yesterday, the owlet launched himself into the air, careened in a lopsided circle and toppled at the brink of the river. Clinging with talons and beak to the slippery mud, to rolling pebbles, to loose twigs and grasses that broke under his weight, the hapless young owl dragged himself up the bank and fell exhausted on the mossy slope above.

The moon had sunk beyond the meadow when at last his mother appeared in the elm above him and tried to call him up to her, back to the safety of the trees. But young Strix was too weary to move, and she finally flew down beside him. Who can say whether the black eyes expressed love and sympathy? However conveyed, he recognized the silent communion and nestled to her a brief moment, comforted.

Then she left him, floating silently past the crossbeams of the old bridge. This time the tables were reversed. A slight flutter in the shadows had shown her where the phoebes had their nest. One bit of meat is as good as another, and the birds that had caused his mishap now gave him the nourishment he needed to regain his strength.

A pair of phoebes made their home beneath the covered bridge.

For the rest of the night the old owl stayed with him, leaving the care of the younger sisters to their father. As his strength returned she led him, hopping and tumbling, around the river's bend to the iris-fringed pool below the nest tree. Here they bathed, and as the water rippled over his feet and splashed through his ruffled feathers young Strix was revived.

So the summer passed for the crippled owlet, resting by day in the tangles of grape vine and green briar, sporting along the river by night. In time he learned to fish as his mother did, sitting sphinx-like on the bank that jutted beyond their pool into the current. He learned to spot the fish well upstream, to time the deft stab as it drifted into the quiet back-water of his pool. Here was a game he could play in spite of his handicap, and the bird was well content by the river side. When

he tired of fish there were frogs and crayfishes, an occasional snake, snails, spiders and a host of small crawling creatures to give variety to his diet. For a few months his mother brought him mice and other food from the woods, but as the nights grew crisp with the approaching fall the young owl found himself increasingly alone.

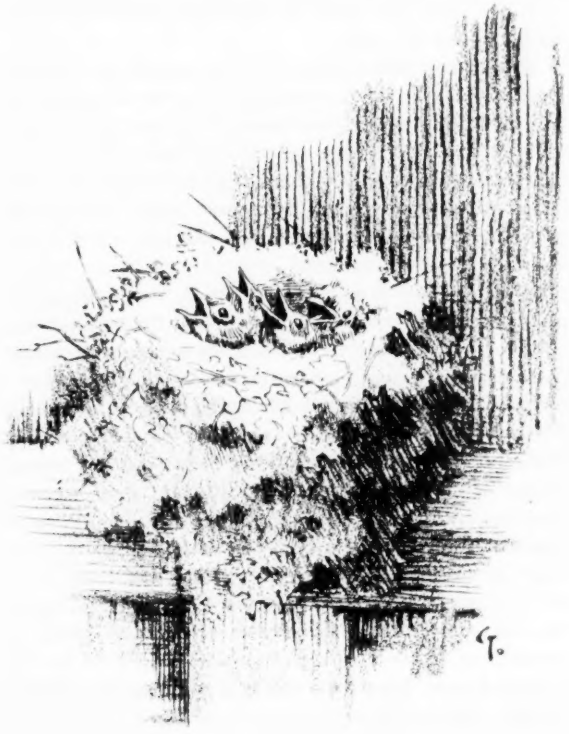
Clumps of Indian pipes reared graceful, ghostly heads.

It was during the storms of the early fall that the river flooded. Overnight the lazy stream became a torrent, ripping stones and trees in its path, spreading out in a wide lake over the bottomlands. As dawn filtered through the sodden valley and the rains had not yet ceased, the young owl shook himself and hopped from the shelter of the leaves. Rain or no, he needed to catch at least one fish before he must hide again from the creatures of the day. With his lopsided gait, half flight, half waddle, he made his way from one low branch to another, traveling in a circuitous route to the little pool. But every landmark was gone. The water tumbled three feet deep over the bank where he was wont to sit, and washed the roots of the old sycamore far up on the slope. Perplexed but undismayed, young Strix sought out a new perch on a great log that jutted out into the current.

Perhaps an older bird would have shown better judgment. Perhaps the owl himself would have recognized danger under different circumstances. But so intent was he upon his task that he did not see the floating hulk of the old chicken coop until too late; too late to waddle and flop; too late to raise helpless wings instinctively for flight. As the coop swirled in the current, it ripped with a mighty splash into the log upon which young Strix was perched. Suddenly the log swung loose from the bank, and rolled over into the flood.

The sun had risen well above the treetops and warmed the chilled body of the owl when at last he opened his eyes. He was in a woods strange to him, an open, sunlit grove of towering beeches, lying stiff and sore upon the wooden slats of the old chicken coop. His clenched talons still gripped a shred of bark from the log that had almost been his undoing.

Thus it was that young Strix found himself in a territory unclaimed by others of his kind. It was a good home, far from roads or farm houses, and as the flood receded it left a rich harvest in its muddy wake. For weeks the crippled owl lived an abundant life, clearing the grove first of the small creatures that had been washed up by the flood, then those that had been weakened or driven from their homes. By mid-winter he was back on his fish diet, but he never lacked for food, as the season was mild and the river did not freeze.



As the days began to lengthen into spring a strange restlessness gripped the owl. No longer satisfied to perch close to the ground, he found himself clambering higher and higher into the gray limbs of the beeches. It was a night in March, when the last snow had melted from the north slopes, when spring beauties and hepaticas were lifting delicate blossoms above the brown humus, that Strix first heard the call that opened up his heart. From far down the valley drifted a lonely cry, a long-drawn, rhythmic cadence—"Hoo-hoo, to-hoo-aw." Wild and ringing, even in the distance, to you or me it might have meant the baying of a dog, the wailing of a banshee, but to the receptive heart of Strix it meant but one thing. Scarcely aware of his need, he answered the call, loud and deep and vehement. Then, from up and down the river he heard the clamor of barred owls, hooting and gabbling and shouting their claims, each to his own piece of woodland, an exuberant, derisive chorus that made bedlam of the quiet night.

Again came the notes that echoed through his entire being, the passionate cry of another as lonely as himself. Gradually the calls came nearer; beseechingly he answered. And at last she sailed into the giant beech tree beside him.

Gravely he bowed, welcoming her with a soft "Hoo-hoo-aw." She nodded in return, spreading her wings

and wobbling her head. For two lonely owls love comes at first sight. Throughout the night they voiced their love, lisping tenderly, shouting their joy in wild, maniacal laughter, chuckling and chortling, proclaiming in raucous defiance to the world that here they would dwell together, barring all others.

Together they nestled in a shallow cleft for the day. When evening came again, she touched his beak gently and glided into the shadows. He watched her drifting from one tree to another, probing into each clump of dead branches or leaves, each hollow in the old beeches. She was choosing a nest; his mate!

Now she returned to him, and after a brief ecstatic cackling she nudged him off the limb. Surprised, he flopped to the ground, where she followed and nudged again, then sailed to a nearby limb. So that was it! She was leading him, as his mother had done in the days of his babyhood. Eagerly he followed as she guided him upward, to the top of the hill, to the topmost crotch of the tallest tree, where the green world of woods and meadows spread out in a mosaic of moonlight and shadows.

It was a beautiful nest she had chosen, solidly built of large, interwoven branches, firmly lodged in the misshapen top of an ancient beech. There was little to do to it except to scratch out the loose leaves that had drifted into its spacious interior. And this was well, for the pair had neither instinct nor inclination to do much renovating. Soon after that she laid her large white egg and settled down to brood it. Two days later there was another. Contentedly, Strix kept the nest by day and she by night.

But every pair of birds is not as fortunate as old Strix of the sycamore, and this, his offspring, was not destined to father a brood of downy owlets. Disaster came at gray dawn, when the owls were wont to change places on the nest. Seeing him as he waddled from the river she sailed off down the valley, and a squirrel frisked into view. Strix watched it spring lightly across the network of branches. He saw the bushy tail wave exultingly over the nest. In anguished haste the crippled owl flopped up the slope and clambered up the great beech. There were only yolk-smeared shells.

They tried again a few weeks later, two more white eggs to hug beneath their hearts, day after day, night after night. The full moon came and went and the new moon fattened again as their time drew near.

Then came the spring rains. Faithfully the owls huddled over their precious charge, spreading broad wings to form a watershed over the rim of the nest. But however broad of wing, a pair of owls cannot hover the fields and gardens that lie, day after day, too muddy to plow.

At last came a morning when the grove was invaded by a noisy band of men, with saws and axes and a well-intentioned ambition "to make every day count." One can always build up the woodpile in a slack season. They marked the old trees first, scarred old veterans whose branches were twisted with the storms of a century and whose trunks resounded hollow to the axe. Hunched on his nest, Strix felt each ripping stroke of the saw reverberate through his whole being. The great beech shivered, the upper branches began to sway, and at last the faithful owl tumbled in erratic flight from the nest. Half soaring, clutching at the branches as they swayed dizzily about him, he finally sailed clear and caught his talons on the branch of a nearby tree.

There he huddled the rest of the day, stiff and motionless. At twilight his mate came from across the river whence she had fled. They searched all night, but they never found the nest or the two round eggs.

Summer came upon them then, and it was too late to renest. And so the owls drifted aimlessly up and down the valley. During the "dog days" of August the life of the owls took on an even slower tempo, for it was the season of molt. But in the crippled body of Strix a wonderful change was coming. The injured wing tip, long since healed, bore strong new quills. The shattered pinions, broken at mid-shaft by the thoughtlessness of a boy, were pushed out one by one and replaced by a row of waxy sheaths.

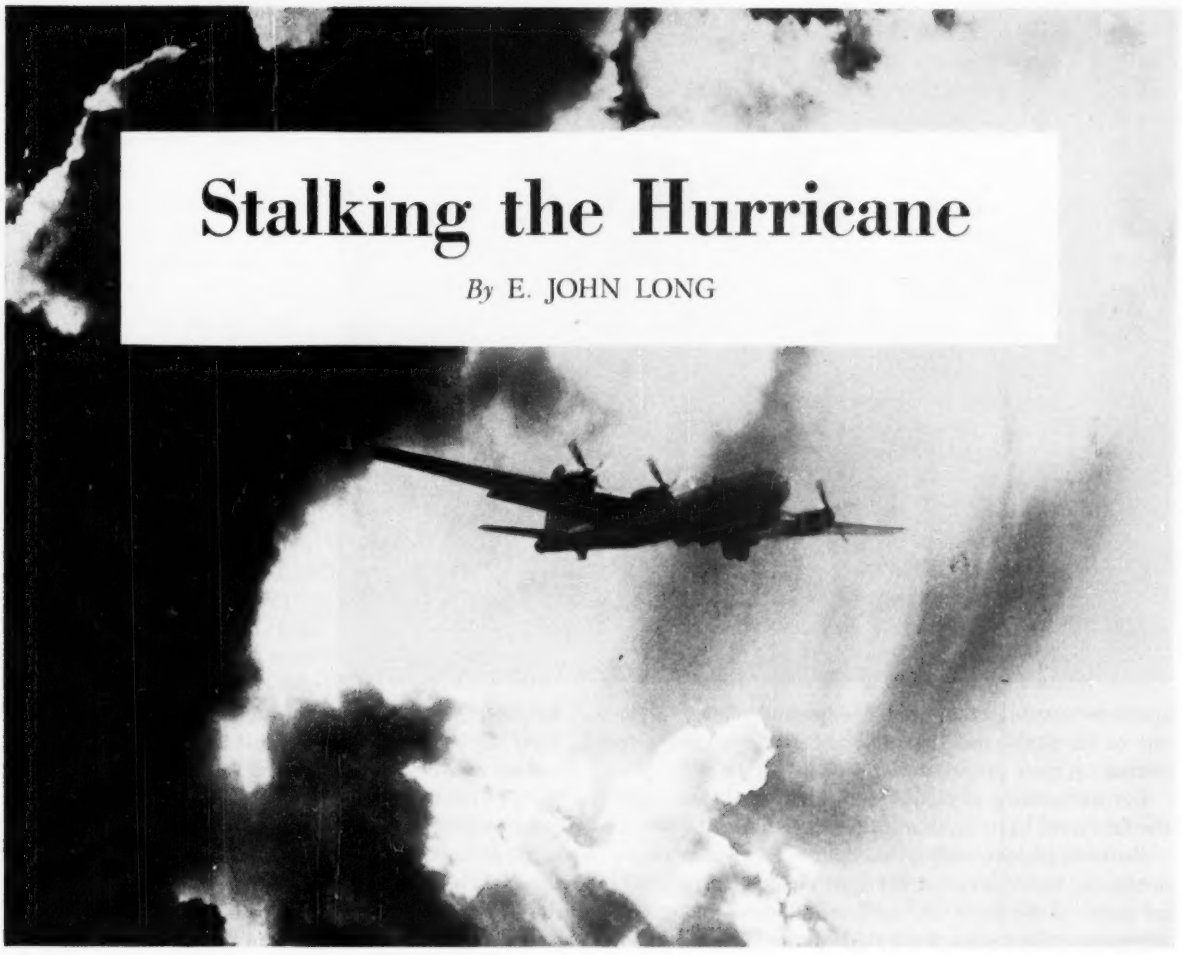
As the last feather unfurled the owl spread his magnificent wings and soared. He was no longer earthbound, no longer a cripple sulking in the shadows for carrion, humping on muddy stream banks for fishes and snails. Through the beeches he sailed in an ecstasy of motion. Farther and farther, past the river's bend and the covered bridge, across the great meadow, through shadowy woodlots and open fields and gardens.

And now it was the season of terror, when men and dogs invaded the world of the wild creatures, when even the farthermost recesses of the woodlands were not safe, and the peace of the valley was shattered with the roar of guns.

It was the crows that were his undoing. Driven from the fields, they congregated by the hundreds in the swamp across the river, where Strix, too, had sought refuge. A crow's bright eye will ever spot his ancestral foe, and soon a black cloud was hovering over the hunched form, diving at his round head, cawing and croaking, heaping upon the innocent bird all the vile epithets of crow language.

But this owl was no longer a cripple, bound to endure their taunts in abject hopelessness. Strix could *fly*. Defiantly he snapped his beak at the invaders; proudly he spread his brave new wings. Weaving through the tangles, dodging his black tormentors, he sailed out of the swamp and across the river, over the heads of two hunters, brown-clad and motionless among the brown leaves of the underbrush. An owl—fair target for any gunner! A shot; a blur of wings; a tumbled heap of feathers, soft brown and gray, and mild black eyes forever closed within the frame of bars and buff.

Next year old Strix of the sycamore will nest again by the covered bridge above the river's bend. But the gentle owl of the beech grove will call in vain for her crippled mate. Disaster comes in many forms to children of the wilds.



Stalking the Hurricane

By E. JOHN LONG

WHY are there fewer deaths from hurricanes, and less property damage? Are the "big winds" getting weaker, and fewer in number?

As a matter of fact, the hurricane remains one of the most powerful and potentially destructive forces on earth. In 1952, during the "hurricane season," six of these colossal whirlwinds roared through the American tropics with momentum enough to carry several of them far on into the north as the worst storms of the year. Property damage set no records, however, and no deaths could be attributed directly to any of the six.

Yet in 1935 a hurricane whiplashed across Florida and the dead totalled 400. In 1928 another Florida twister took 1800 lives. At Galveston, Texas, in 1900, a hurricane killed more than 6000, and as late as 1942 casualties from the big winds still numbered in the scores.

The answer, in three words—*better advance warnings.*

Where once hapless communities and ships at sea were unaware of a hurricane's existence until the black fury of the storm loomed on the horizon, they now receive alerts two to three days in advance, and hourly reports of the progress and probable course of the storm.

Teamwork plays a vital role in robbing the scourge of the tropics of many of its terrors. On the team are commercial ships and planes at sea, regular weather stations, the ships and planes of the military services, telegraph and radio networks, radio amateurs, or "hams," and others. Any one of these may spot the first symptoms of the gathering storm. Once the word is flashed, a vast integrated organization comes swiftly into action.

The "Big Three" in the nation's weather observation league are: the U.S. Weather Bureau, the Air Weather Service of the U.S. Air Force, and the U.S. Navy's Aerological Service. Although each specializes in a specific mission, they work in close alliance and harmony when danger threatens. Normally, the Weather Bureau issues forecasts and warnings for the general public; the Air Weather Service provides storm information for Army and Air Force operations; and Navy Aerology sends out the type of weather data needed for Naval operations.

When a hurricane moves in, they pool their resources as members of a well-drilled team dedicated to a single purpose. For, while no one has yet devised a reliable means of shattering or dissolving a hurricane, or even of altering its course, a great deal of progress has been made in removing its sting by timely and

At the height of a hurricane that struck Ocracoke, North Carolina, bringing floods and leaving destruction in its wake.

OFFICIAL NAVY PHOTOGRAPH

accurate warnings that enable ships and planes to get out of its path, and that also permit groundlings to button up their property and get to shelter.

Let us follow a typical West Indian hurricane from the first word of its birth until it finally blows itself out.

Because, almost without exception, hurricanes originate over water areas in the hot, moist doldrums not far north of the Equator, the first inkling of their existence generally comes from ships at sea. The skipper of a lonely freighter, heaving gently along a glassy smooth ocean, may notice with some concern that his barometer is falling! Low pressure in this area in the hurricane season generally means only one thing—a big blow is shaping up nearby.

But where? From which direction will the gale strike? And how soon?

He flashes his position and the barometer reading by radio to the joint Air Force-Navy-Weather Bureau Hurricane Warning Center in Miami, Florida. If this is the first report of a major disturbance in the region, a far-flung coordinated organization will spring to action. On a big scale it is like yelling "fire" in front of a fire station.

First Miami will alert the military reconnaissance squadrons—the hurricane hunters—whose planes are standing by at Jacksonville (Navy) and at Bermuda and Puerto Rico (Air Force). Vessels known to be in the area of the report are asked to send barometer readings and to radio any suspicious signs; scheduled airliners are warned to be on the watch.

TAMPA DAILY NEWS

The square red flags with black centers are hoisted as warning that a hurricane is being stalked and may arrive.

As yet no actual hurricane has been seen.

In the acknowledgement to the freighter that sent the original advisory Miami asks for position, wind and barometer readings every half hour, or oftener if the towering, wedge-shaped mass of the hurricane is actually sighted.

From Jacksonville, Bermuda and Puerto Rico, depending upon which base is closest to the position given by the freighter, a specially equipped search plane takes off. Virtually a flying meteorological laboratory, its trained crew is ready to do what no other airmen in their right minds would do—head for *and into* turbulence!

Although their run-ins with death bring them no extra pay, this is no stunt. In addition to confirming the existence of a hurricane, they must also send back the weather data that hitherto was the missing link in calculating accurate forecasts of the speed and direction of the big twisters. And to get these data the hurricane hunter can not just play tag around the edges of the storm, nor fly over it (some of them tower 60,000 feet above the sea). He must penetrate the maelstrom itself, and locate the "eye," or center. Here he must remain, making readings of aerological instruments and radioing his findings to shore, as long as the fuel supply will permit before kite-tailing for the nearest base.

While the search plane is stalking its quarry let us take a quick look again at what has been going on ashore. Since the Weather Bureau reorganized and expanded its Hurricane Weather Service in 1935, a special hurricane teletype circuit has been set up, linking all Weather Bureau city and airport offices on the Gulf and Atlantic coasts from Brownsville to Charleston. Every message written on the line is automatically received by all stations. A private circuit also connects the three forecast centers on

the Atlantic Coast (Boston, Washington and Miami) to the hurricane teletype circuit.

All of this would be quite adequate for handling intelligence concerning ordinary storms, frosts, drought conditions, etc., but not hurricanes. Then the forecast centers must call also upon the regular and special reports of Coast Guard stations, lighthouses, military mobile units, as well as the messages from cooperating foreign weather stations in Cuba, the Bahamas, the West Indies, and in Central and South America. Radar stations, military and private, and amateur radio or "hams" also observe and report on big tropical storms.

WEATHER BUREAU PHOTOGRAPH

A freak of the hurricane, a Puerto Rican royal palm pierced by a pine board ten feet long, three inches wide and one inch thick.

During the progress of a major hurricane, no matter how distant, the Miami Center daily issues four advisories—weather version of a "war "communique"—based on a compilation of reports received during the previous six hours. Each Weather Bureau office in the network then gives the forecast as much and as rapid distribution as possible.

This generally is not difficult, because the approaching big wind quickly becomes the number one item of news interest to every newspaper and radio station in the area. Reporters stand around-the-clock watches and radio microphones are set up right in the Weather Bureau offices. Precautions against hurricane damage —such as boarding up houses and shops, flying planes to safer regions, moving small craft, etc.—are expensive, so everyone wants to know: *"Is it or isn't it the McCoy?"*

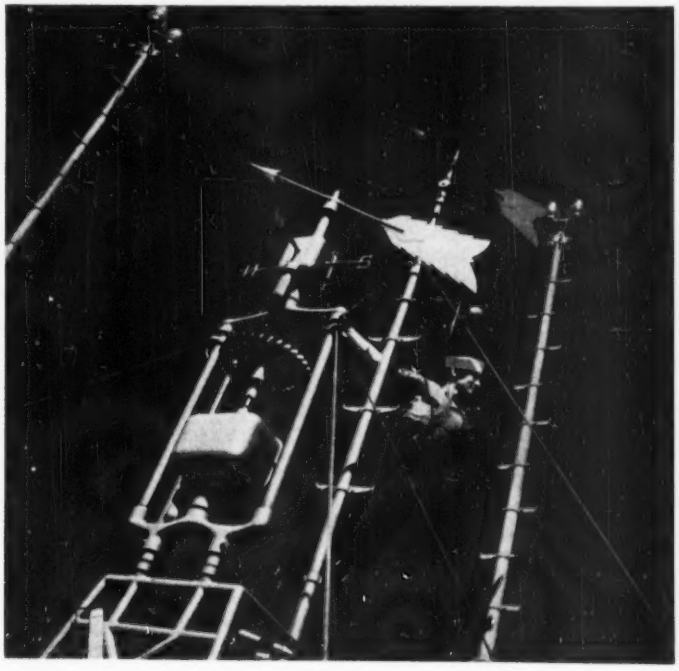
To return to our hurricane plane. Far ahead through the rain squalls the pilot sees a dark, ominous-looking mass of whirling clouds, mist and water that seems to reach up into the heavens and stretches fully thirty miles from side to side. The plane has made contact with the enemy! Tapered like a wedge, big at the top and narrowing at the bottom, the growing storm has already traveled a hundred miles or more from the area where the freighter noted the first clue to its existence in its falling barometer.

As the crew takes another notch in their safety belts, the pilot radios Miami confirmation of the hurricane's existence. The first act of the Hurricane Warning Center is "to christen the baby" with a name—for instance, "Baker," from the International Phonetic Alphabet used in radio voice communications. This, let us say, is the second hurricane of the season. If it had been first it would have been called "Able." Third would be "Charlie," fourth "Dog," fifth "Easy," sixth "Fox" etc., down to "Zebra" (heaven forbid!).

Now the plane's aerologist calls the signals. Because a hurricane's most vulnerable point is usually to westward, he requests that an approach be made from that direction, although at the last minute he may ask for a southwest approach. No two hurricanes are exactly alike, so those who stalk them must be just as prepared for the unexpected as is a football safety back.

In the remodeled bombardier's compartment the meteorologist, surrounded by instruments informing him of conditions outside, checks the intercom as he prepares to report to the radio operator of the plane. The radar operator does likewise. Every fifteen minutes from now on a radioman (planes have three radio transmitters and a radar set) will relay data to Miami.

Before getting any closer to the hurricane the pilot brings the plane down to an altitude of 800 feet, and may drop to 400 feet if visibility is poor. Although such a low altitude is hazardous, the risk must be taken to obtain necessary observations on actual sea conditions, surface winds and pressure. The plane shudders and shakes as it bucks the outer rings of light thunderstorms and 30-knot winds, which try to drive the plane south-



A aerologist goes up to take a look at the weather at one of the U.S. Navy's shore stations.

OFFICIAL NAVY PHOTOGRAPH

In the wake of a hurricane that swept through Fort Pierce, Florida.

OFFICIAL NAVY PHOTOGRAPH

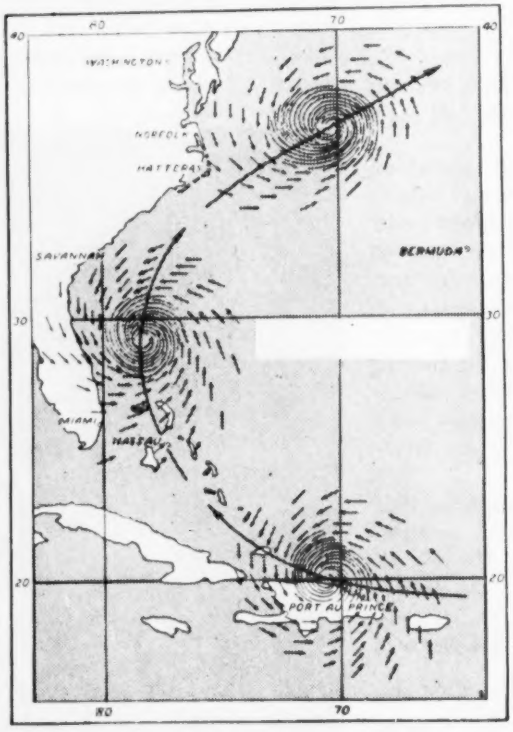
ward, forcing the pilot to "crab" to hold course.

Nearly an hour is spent sampling the air on the fringes of the hurricane, that is, "boxing" the circular rim of the storm. Up and down the plane bounces violently, like a cork in a rapid. Then, with a brief: "Hold your hats kids, here we go again," over the intercom, the pilot heads directly into the monster ahead, for all the world like little David ramming his head into Goliath's shins!

If the plane seemed to toss wildly before, it was nothing to the blindfolded madness that has seized it now. The heavy, four-engined ship pitches and yaws, dives and soars again, until its creaking frame seems to be tearing apart. Sea and sky dissolve in pelting rain and spray, and the shrieking wind drowns out even the roar of the engines, straining at full throttle.

An interminable quarter-hour of this and suddenly the plane breaks through the storm into the clear. All pitching and tossing ceases, the howling gale quiets as if a valve had shut it off, and bright sunshine pours through the drenched windshield. Down below, the sea shows a few whitecaps, but the whole general aspect is one of peace and calm. The transition is so sudden and unexpected that it comes as a shock, even to air crews that have experienced it many times.

This is that strange world called "the eye of the hurricane," surely one of the wierdest, most awesome sights on earth. The eye is roughly circular. Its boundary is a vertical curtain of black, reaching from the ocean far up to the open sky above. It is difficult to believe that beyond this ebony cylinder, now 10 to 15 miles in diameter, is a watery chaos, revolving furiously in a counterclockwise direction as it is driven by gales of 150 to 180 knots.



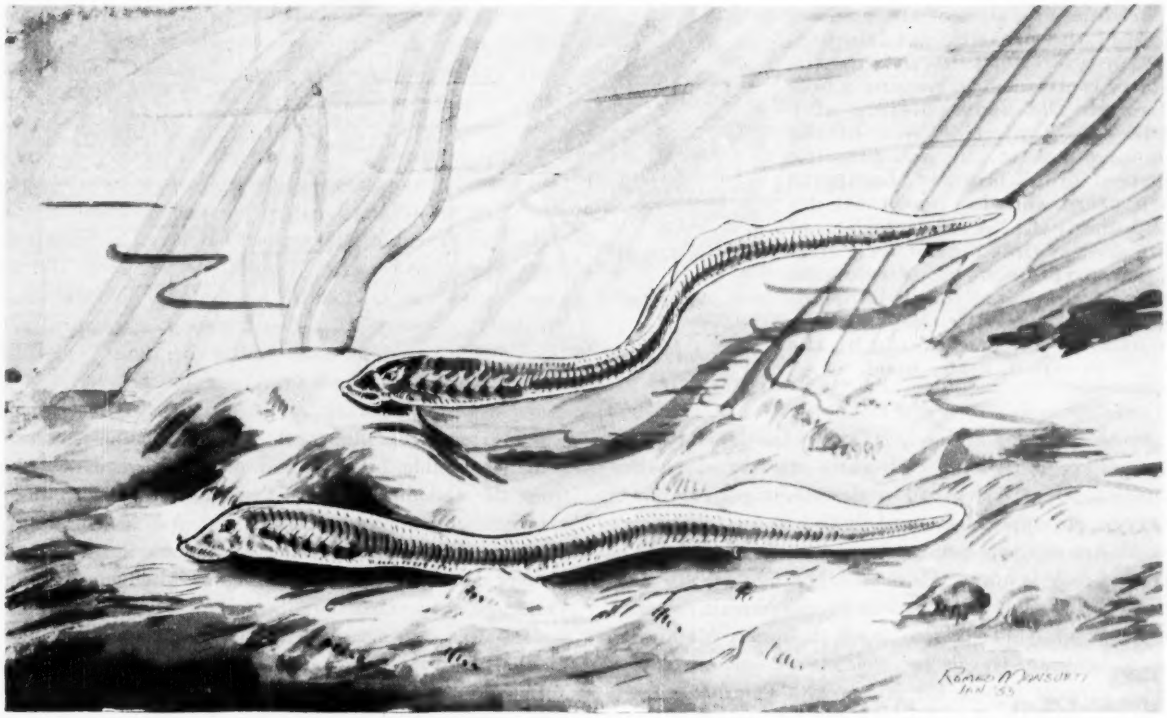
The track and wind system of a West Indian hurricane.

Strange things have been observed by planes cruising the eye. Flocks of birds sometimes take refuge there, moving along within the comparative safety of the storm's vortex, which may have a forward motion of only ten to fifteen miles per hour. Ships sometimes seek the eye to ride out the worst of the storm's violence before resuming course. One plane observed a fishing boat, with the crew on deck sunbathing, within a hurricane eye. What happened to them is not recorded.

Lil' David, the hurricane-stalking plane, meanwhile has not been idle. As it cruises around the eye, the dropsonde operator goes into action. The dropsonde, as its name indicates, is an instrument dropped from the plane by parachute. As it slowly descends it automatically records atmospheric pressure, temperature and humidity of the air, and relays these data to the plane by a self-contained radio transmitter.

But now the fuel guage is reaching the "point of no return," so the pilot plunges back into the black wall of the hurricane. He chooses the western or "weak" side, where experience has taught him that a hearty tailwind may be picked up to boost the plane along in its final slugfest with rampaging elements. Fifteen minutes more of furious buffeting, and the tired crew heads for the barn, clipping through squalls that would be bypassed by ordinary pilots.

If the hurricane meanwhile has (Continued on page 386)



The eastern brook lamprey, *Lampetra aepyptera*, is a small, non-parasitic, harmless creature that inhabits fresh-water brooks and streams of the Atlantic coast lowlands and parts of the Ohio Valley. It goes through an unusual life history cycle; (a) the young are hatched from eggs and burrow into mud and remain as hooded, toothless larvae, or "ammocoetes," in this environment for three to five years; (b) in autumn they transform into an adult-like lamprey and the digestive tract becomes degenerate and the metamorphosed individual does not feed; and (c) it lives until early spring without feeding, and then reproduces and dies.

Little "Eels" of Mystery

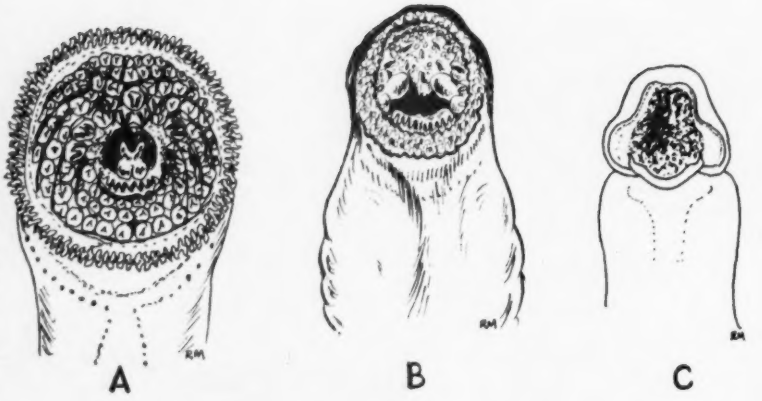
By ROMEO MANSUETI

Illustrated by the Author

IF NATURALISTS had to choose a candidate for the most curious anomaly in Nature, the brook lamprey might take first prize. This fresh-water "eel" could claim the award because it does not eat food after it has become an adult. In the higher animals, this habit of life rarely occurs. The brook lamprey is a chordate, and theoretically in the upper echelon of animal life. It accomplishes this feat of adult fasting because its digestive tract becomes degenerate when the animal transforms from the larval stage. It then merely exists until the next spawning season, and few organisms live such an unorthodox existence.

Brook lampreys are non-parasitic members of a much maligned and little understood family of fish-like creatures. Many people regard them as vicious characters in the fish world. Actually they are harmless creatures, and among the most primitive eel-like animals of North America. In reality, they are not even closely related to true eels or other fishes that we know. Differing from the true bony fishes in important anatomical details, the lampreys have no jaws or no paired fins, but do possess gill pockets. These look much like ventilators on the side of the head, instead of regular gills hidden beneath gill flaps. Despite their lowly stature in the family tree of fishes and their relatives, they, and their parasitic cousins, have commanded some attention in recent years.

The sea lamprey, a most serious parasite among the chordates, has received wide and unfavorable publicity, and the innocuous brook lamprey has suffered because of this. An unestimated amount of damage is done by the predatory lamprey to sport and commercial fishes in the upper Great Lakes. Since the sea lamprey, as well as the chestnut lamprey, silver lamprey, and Oregon lamprey, are parasitic, most people have considered all lampreys undesirable. This guilt by association will probably result in the destruction of many harmless brook lampreys undeserving of such a fate.



(A) Underside view of the sucking disk of the parasitic sea lamprey, *Petromyzon marinus*, showing the horny teeth used in rasping a hole through the body covering of a fish. (B) Underside view of the sucking disk of the non-parasitic eastern brook lamprey, *Lampetra aepyptera*, showing poor tooth development that is characteristic of the species that do not feed after metamorphosis. (C) Underside view of the larval brook lamprey, or "ammocoete," showing the toothless mouth overhung by the squarish, fleshy hood.

Brook lampreys are aptly named. They spend their entire lives in smaller fresh-water streams of North America, where the several species are, in general, nondescript in appearance and little-known. Western North American species are the western brook lamprey, Arctic brook lamprey, Mexican brook lamprey; while in the East we find the American brook lamprey, eastern brook lamprey, Tennessee brook lamprey, Michigan brook lamprey, Gage's brook lamprey, and Greeley's brook lamprey.

The eastern brook lamprey, *Lampetra aepyptera*, was for many years considered a rare and somewhat mysterious species. Recently, it has turned up at a number of scattered localities, and, at present its known distribution is through the middle Atlantic and southeastern United States. In Maryland and the Delmarva Peninsula it inhabits the sluggish creeks and millponds. During spring the lampreys make their short annual migrations in such numbers that they have excited the wonder of both laymen and scientists. They seem to appear out of nowhere, remain in the streams in plain view for a week or two, then disappear until another school returns the following year. March and April are the months during which the adults ascend the narrow and shallow streams from millponds and deep muddy holes in creeks. At this time they may be mistaken for loose strands of grass being bent and swayed by the swift current. Actually the animals are resting on rocks and grass in a curious manner. They attach themselves by means of their sucker mouths and remain firmly attached until they are further stimulated to progress upstream.

After a few days of migration, the adults settle down to spawning activities on gravelly riffles. The mating pair constructs shallow depressions or pits about the length of their body, or perhaps eight inches long, in streams less than two feet deep. These are laboriously prepared by selecting pebbles about half the diameter of a dime and transporting them from the nesting site. In addition, the lampreys may adhere to a large upstream stone or a blade of grass, and by means of a vibratory motion of the hind end of the body, they help to smooth out the hollow of the nest. The males are easily recognized by a well-developed tube, or papilla, which extends from the vent; the tube in the females is barely visible. The sexual products are extruded from the abdominal cavity through this tube to the exterior. In another species, the American brook lamprey, *Entosphenus lamotti*, Dr. Jacob Reighard, a pioneer fishery biologist working in Michigan many years ago, discovered that the second dorsal fin of the females was considered to be specialized as a support for the tail of the male in spawning.

Both males and females contribute to nest building. The courtship pattern of the brook lampreys appears to be relatively simple, and yet there are characteristic steps in their behavior before actual egg-laying. The two sexes assume parallel positions, and a vigorous entwining action of their bodies takes place. This is followed immediately by the emission of a small number of eggs. As they are exuded over the nest, the male fertilizes them with milt.

Ruth Crosby Noble, in her interesting book, *The Nature of the Beast*, has provided some information regarding the nuptial behavior of lampreys. She states: "The male lamprey eel evidently distinguishes sex by means of his *kinesthetic* or muscle sense. With his suctorial mouth he attaches himself to another individual clinging similarly to a large rock. If the second lets go its hold on the rock it is a male, and the two float downstream together to separate anon and swim back to try their luck once more. But if the second individual maintains its hold on the rock it is recognized as a female, and the two unite in a vigorous churning of the water in which the eggs and sperm are deposited and mixed with sand."

Dr. S. H. Gage, one of the earliest investigators of lampreys in New York State, stated that a female American brook lamprey may lay more than 3000 eggs. The fecundity of the eastern brook lamprey probably does not differ very much from this figure. The eggs are quite small and whitish, their diameter being about one millimeter. They superficially resemble small frogs' eggs, since they possess a gelatinous envelope. The eggs are sticky and adhere to the gravel and are believed to hatch in a few days.

Lamprey hatchlings are bizarre-looking animals. A fleshy hood overhangs the horseshoe-shaped mouth,

which is toothless. To some people the creatures may look like a bonnet-bedecked eel. They appear to be quite blind, although the eyes are rudimentary and deeply imbedded in the tissues of the head. After the young make their appearance, they drift downstream until, presumably, they become lodged in the mud or sand of a bank in some quiet backwater. There they burrow into the bottom material and spend three to five years as larvae, feeding on minute plants, animals, or bits of organic matter, which they strain from the oozy layer on the bottom. Biologists and bait-sellers catch them by digging them out of stream bottoms in shovels of sand, which they sieve carefully.

Few people have seen larval lampreys in Nature, but many use them as fish bait, mistaking them for elvers. Known as "ammocoetes," the larvae grow about four or six inches in length during their submarine sojourn. Practically every month of the year in Nature ammocoetes may be found in different stages of transformation. During late summer and autumn, by a slow process requiring several months for its completion, they are changed into an adult-like lamprey. They also lose their hood, gain a sucker mouth with a variable set of teeth, and the eyes appear on the surface and reveal a transparent cornea. But some curious quirk of evolutionary fate has willed that the disc and teeth shall be useless for feeding.

Brook lampreys are rarely more than seven or eight inches in length at metamorphosis. At the same time their gut is reduced to a strand, and, consequently, becomes non-functional. In parasitic species the digestive tract remains functional. While brook lampreys have a sucking-disc mouth, the teeth are small or absent. This is in direct contrast to the buccal funnel, or mouth, of the parasitic species, which have well-developed teeth. With these, the parasites rasp a hole through the body covering of a fish, and suck nourishment from the host.

Although feeding stops in the adult eastern brook lampreys, they continue to grow in length after metamorphosis. Where they derive nutrition for this extra growth is not known. Most of the breakdown of stored bodily food is utilized for the production of eggs and milt. Where the adults go after transformation is one of the mysteries in the life history of this species. A clue to the answer of this question was found in a millpond on the Eastern Shore of Maryland. More than one hundred eastern brook lampreys were discovered on the bottom after the body of water had been poisoned and drawn down for fish management purposes. Many more lampreys probably escaped notice. Many were larval forms, and others were in intermediate stages of transformation, while the majority were adults. It is believed that many of the millponds represent reservoirs or depots for lampreys, especially when many of the streams run low or dry up in summer.

Why brook lampreys migrate from one end of a stream to another is not well established. After a few months, or as much as one-half year, following metamorphosis, the adults are probably stimulated by changing water temperatures, freshets, and lengthening of each day during early spring. No one really knows. After the rigors of spawning, lampreys are weakened, and it is supposed that the spawned-out or spent adults all die. A pair of eastern brook lampreys have been observed to live from five to ten days after spawning. Dr. Herbert F. Seversmith proved this when investigating the embryological development of this species in Crow Branch, near Laurel, Maryland, just a few miles north of Washington, D. C. He noted, also, that when a pair was separated, both died sooner, in three days. They did not feed, and presumably starved.

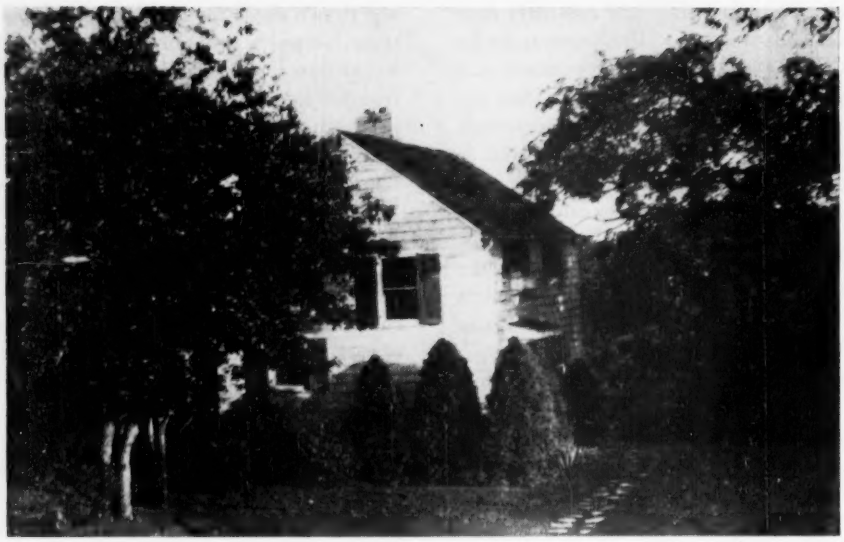
It is unfortunate that we feel we must credit some beneficial act or economic value to the many living things in the world of Nature. Brook lampreys, per se, have not contributed any significant material gains to humanity, nor have they incurred any debts. On the other hand, ammocoetes are dug out of stream bottoms to be sold as fish bait for prices ranging from 50c to $1.75 a dozen. They are hardy, and for this reason are much desired by fishermen.

Zoology students are introduced to a wide variety of animal forms, but the brook lamprey represents one of the more important links between lower and higher chordates that they must study. It has been stated: "Among living animal, the larval lamprey is regarded as most like the prototype of the vertebrates." In addition, they are occasionally used in fundamental zoological research. For example, some lampreys possess an elaborate median pineal eye (also known as the "third eye") with clear lens and pigmented retina. The primitive sphenodon, or tuatara, of New Zealand is the only other animal that possesses a well-developed pineal eye. Ammocoetes are also believed to constitute an important link in the natural food chain of some stream fishes. Much more information about the biology of the brook lamprey is desired, and, only time will tell whether it hides any more attributes of value.

Palomar Perspective

By ELINOR HENRY BROWN

The men who live on Palomar
learn much about each single star
with their prodigious eye.
I think sometimes they leave a door ajar
and go outside — to see the sky.



C. B. STRAVS, ARCHITECT

A Home Is for Living

By THOMAS J. MALONE

WHEN you buy or build a home at the city's edge you acquire more than the structure itself and the land upon which it rests. You become co-owner of the neighborhood, of the region around, with its slopes, levels and open spaces, its trees and water courses. You have a stake in the wildlife, a-wing and a-foot. You are concerned with the site's relation to the wind, its place under the stars, its view of the full moon on parade.

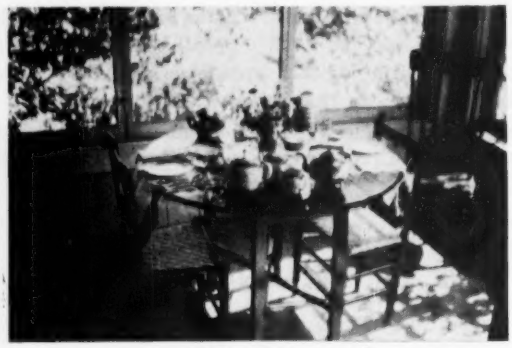
One day, not long after we built, I was on my knees in the side yard, digging behind a rosebush. Two early teen-age boy hikers went by, both strangers to me. "Boy, wouldn't you like to live here!" I heard one of them say.

Our place sang that way to us through our years there. We came to take for granted that just about everybody approved it—the house, its hillside and creek-valley setting. But when an emergency arose that caused us to offer the place for sale, we found that by no means everyone approved it. The things we liked most about it were the very things to which some people most objected.

When you sell a home, you sell not only the physical properties of building and site but all the cherished associations that go with them. But a buyer owns no memories of the shadows of a fire in the grate flickering on the walls of the darkened living room; the leaves of the red oak aflame in the setting sun; the cardinal nesting in the arbor vitae beside the kitchen window. A new owner has yet to hear the gurgle of water rippling over stones in the creek below; to know Bunny and Barry, neighbor children coming in to recite a new piece or have a little visit. Such memories have no measure in money, no part in the purchase price. They are a part of *you*.

We miss things so; not the man-made things only, like house and walks. We miss the little things that seemed of slight moment when they came about, often without planning, and worked their way into our lives—things like the grosbeak, and the redwing, and the brown thrasher.

That grosbeak just about adopted us. He may not always have been the same grosbeak, but we liked to think he was. Each summer he hopped about in the oak shading our porch and peered down on us eating there, in his near-sighted, grandfatherly way. He would give his little warble over and over again to keep us aware of him, and would come to ground promptly when we tossed him a bit of bread.



There were meals on the porch, morning, noon, and night, when the weather allowed. This "eatin' " porch faced north, east and south, and looked out upon the valley.

The red-winged blackbird—we think he was the same one, too, each year—would sail in when the grosbeak was away,

The famous Minnehaha Falls of Longfellow as they were in May of 1952. They are now administered by the Minneapolis Board of Park Commissioners, which supplied this photograph.

as if choosing his time, and perch in the same tree. His chirp, chirp, sought attention, and, seemingly more intelligent than the grosbeak and surely more efficient, he would follow us around to the opposite side of the house if we moved there and he thought he was being neglected, or we were trying to run away from him.

Accurate as the sun, the brown thrasher arrived annually at our place on April 29 or 30, usually at night, it seemed. We checked him year after year. As we lay in bed we would hear him about sunrise, flaunting his joy in being alive—and, we liked to think, in being back. We would call to one another, "The thrasher is here!" And there he would be, as always, at the top of the highest elm, spraying song in all directions.

Wrens were late comers, arriving in June, or not long before. One spring, curious but not too well advised, we put up a birdhouse in a low tree-crotch over the kitchen walk, a few feet from the door. Two wrens moved in promptly. Soon we were waking, or being wakened, before five in the morning, and so for weeks.

For a week or more one summer, a little owl came at night to the red oak outside the window of my upstairs darkened room and, three feet from my hand, would sit motionless, silent, lantern-eyed, and inscrutable, to ruminate upon life. The merest sound, the faintest passing shadow, and he would float away.

Pheasants found a welcome with us, and good pickings. Mother Pheasant and her brood would come up from the creek bottom several times a day. They would meander about over terrace and lawn, calmly assured that they belonged to the landscape. One morning, the agitation of ground-sweeping spruce branches led to the finding of a gorgeous ring-neck caught by a foot in a steel trap, set, no doubt, by someone after rabbits. The bird may have struggled for hours. When released, it drooped in my hand, and died. In a rainstorm, a mourning dove refused to leave its nest in a roof gutter until nest and contents were washed into a downspout.

A muskrat, when spring brought high water to the creek, favored us with his presence but refused to become acquainted. He was alone, seemingly a bachelor muskrat and a hermit. A raccoon's wavering cry was a common sound in the valley, and once a little red fox passed our way with a rope around its neck, the broken end trailing.

The house we gave up is a small, colonial cottage, shingle-sided. Downstairs, it has living room, kitchen and hall. Both rooms open into a screened open porch of generous size, an "eatin'" porch facing north, east and south and looking out upon the valley. Upstairs, there are three bedrooms and bath. There is no dining room, as such. For eating there was the living room, or the porch, which came close to being the main room in the house.

Approached from the street at the north, the house does not face the street. Instead, it turns its back and faces south, overlooking the Minnehaha Creek valley, in Minneapolis. The living room looks down on the valley, its south windows reaching to the baseboard. The room, the whole house, was designed for sunlight.

Partly hillside, the lot slopes somewhat steeply to the creek, with natural growths of sumac, honeysuckle, hazel and woodbine, of pincherry, chokecherry, nanny plum and bittersweet, mounting virtually up to the house. There are oaks, elms and ashes, too, and even jack-in-the-pulpits in season for those who will look for them.

Friends sending us postcards of the Bay of Naples, or Yosemite Park, were invited some time to see from our windows a snow storm in our valley, or a full moon in a clear sky moving serenely over our creek, its mysterious face revealing nothing of man's preoccupation with plans for a lunar visit.

People who came to see our place, ostensibly with a view to buying, reacted in various, often surprising, ways to what we regarded as its assets. One man looked glumly from the living room on the unconventional mass of native shrubbery. His face did not even light up.

"This could all be cut away, couldn't it?" he asked.

It could; it certainly could. Any man with an axe, a sickle and a strong back could do it. "I'd cut it off and seed the whole thing," he added.

We had lived in fear that the shrubbery would die away in time—wild growths are temperamental, you know—and leave the slope bare, forcing us to sod it and gaze thereafter on monotonous greensward.

He did not make an offer. Although refraining from saying so, lest he hurt our feelings, it was plain he could not understand how any one in right mind would plan and build a house, and, when beyond remedy, discover he had forgotten the dining room!

He was not alone in thinking we were a little queer. There was the woman who told us at the start that she and her husband had lived for fifteen years in an apartment; liked it, too. One gathered it was he, not she, who hankered for a single dwelling. She stood at one of the south windows in the living room. Hillside and valley spread out before her. Water in the creek swirled and eddied around bends, caught the sun in its ripples, sped away on its six-mile journey to the Falls, which, in wet seasons, still "flash and gleam among the oak trees, laugh and leap into the valley," as with Hiawatha.

"This," she said with finality, expressive hands pushing away what we held so dear, "would drive me wild."

It was a woman of opposite tastes who bought the house. On her first call, she looked the place over without commitment. However, when told that an architect had designed the house, she commented, "I'd have known that on sight. I have an eye for line. I'd never build a house without an architect."

She bought after her second call. She had lost her husband not long before. Her only child had grown up and was on his own. She meant to live in the house all by herself. She liked privacy. But she liked company, too; the extra bed rooms were for guests—grandchildren especially.

The day we gave possession she came in the afternoon to match some chintz with the blue tile of the fireplace. The house was stripped. The van had gone. She stood at one of the long windows looking out on the foliage-blanketed hillside, on the tireless water flowing to the Mississippi, to the Gulf, to the Atlantic. After a silence, she said gently:

"Dad—would—have—loved—this."

Right then we knew all about Dad.

You will recall that Horatius, before his famous leap into the Tiber, looked not at the hosts of Tuscany but "saw on Palatinus the white porch of his home." One can believe that it did not occur to him that his house had no nook, that it had too much or too little shrubbery, that it faced away from the street. It was home.

As likely as not he was thinking, "Boy, wouldn't I like to live there!"

Pandanus

By MARY DANA RODRIGUEZ

ANCIENT Hawaiians found six different uses for the tropical Pandanus tree, called by Polynesians, the lauhala tree. These uses have been handed down to the present generation of Islanders.

The leaves of the Pandanus are plaited into mats, fans, purses and other "lauhala" items. The fibrous wood of the older trees is hard and capable of taking a high polish. It is used largely in making bowls and other receptacles. The bright orange-red fruit is used to string Hawaiian leis. The base of the fruit contains a small, rich, edible nut, considered a delicacy. After the seeds are dry, the Hawaiians use them for brushes. In the olden days their fibrous ends were used to apply the various dyes onto their tapa and other cloths.

The Pandanus tree of Hawaii has many uses.

The Pandanus is a screw pine and is common on dry plains and sandy beaches. It is a small tree, fifteen to twenty feet high with a whitish bark. The leaves, which are prickly at the margins, are arranged like a corkscrew. The stout branching trunks and numerous aerial roots growing out of the trunk, as well as from the base of some of the branches, are well known peculiarities of the tree, which is widespread throughout the territory of Hawaii and American Samoa.

The seeds will stand saturation in sea water for months without losing their vitality. Hence they can be readily transported by ocean currents and planted by sea waves on the various Pacific Islands that make up the many islands that are known as Polynesia.

Life on A Blade of Kelp

By N. J. BERRILL

Photographs by the Author

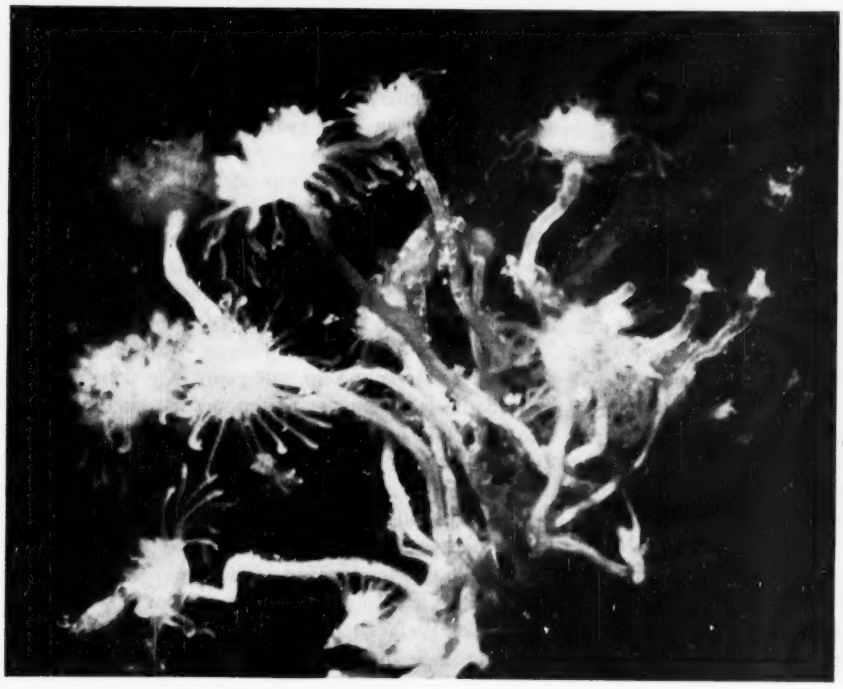
A blade of kelp may be the dwelling place for a wide variety of interesting sea life.

ALONG the margins of the oceans, where the water is cool or cold and the sea floor rocky, the great brown seaweeds find their place. They need more room than the green and red seaweeds, for some of their brown relatives rank with the giants among living things. Such are the kelps or tangles, which, after storms, are often found torn from their moorings and cast up on the beach. Some have broad flat blades; some are long and narrow; some are palmate, like the fronds of palm trees, a shape that bends before a crashing surf and swirls back unbroken in the wash. All have holdfasts that look like roots, which tie them fast to something hard and firm, for once their hold is broken their remaining life is short. The holdfast forms from the end of a stalk, which may be long or short according to the species. The blade grows from the other end; not from the blade tip as one might expect, but from a region close to its base, thus reversing custom in plants.

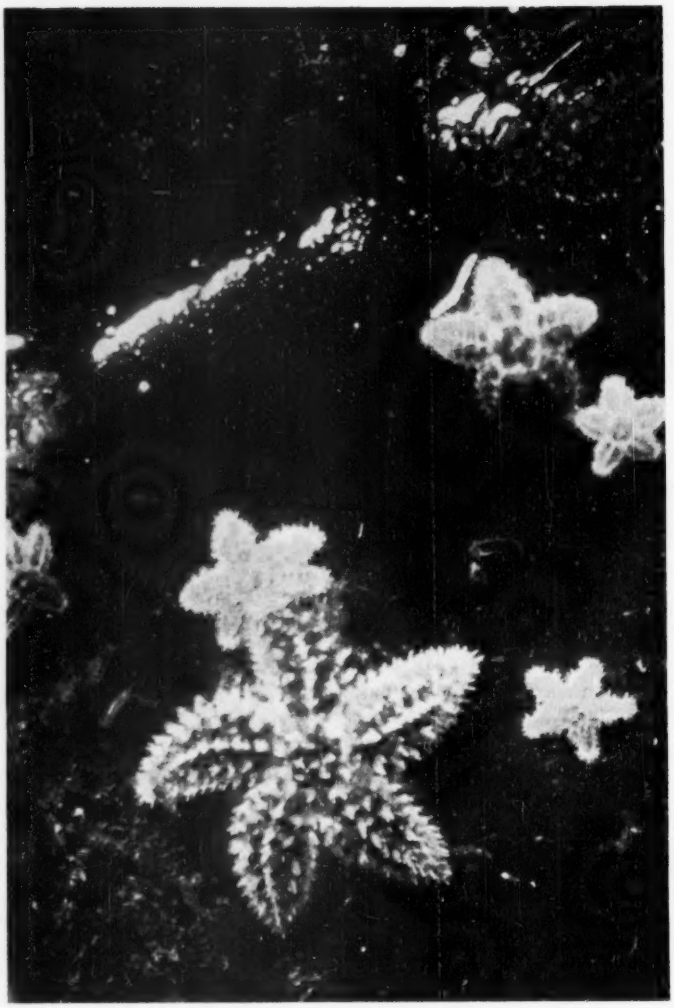
In northern temperate seas kelp often forms submarine forests. These can become so dense that they afford shelter to a host of fishes and many other forms. Sometimes the kelp flourishes in deepish water some distance from the coast, like the great kelp beds off California. More frequently it extends to the shoreline, although not above the level of low water, except perhaps in low-lying pools among the rocks. All farmer-fishermen of the coasts of northern lands have looked upon the kelp as more than just a seaweed, and here and there it has actually been used as food. At one time it was eaten by people in Ireland, Iceland, Denmark and the Faroe Islands, not to mention Scotland, where it was called "dabberlocks." The midrib alone was eaten, stripped of its outer skin, although only when thick and fleshy. It is said to be extremely sweet.

The more important use has been as fertilizer, especially on the farms of the western Highlands of Scotland and among the Hebrides. The heavy seas of winter tear large masses from their beds, and crofters carry the weed from the shore to the farms above. And, in many parts, a failure to get the kelp means a failure of the crops.

Kelp was a name once given not to the weed itself but to the ash that comes from its burning, mostly soda and potash, which were used in making glass and soap. This was a practice in the Orkney Islands early in the eighteenth century, but during the Napoleonic wars, when these islands became the chief source of supply of soda for the Brit-



A young colony of the hydroid, *Tubularia*, has settled near the edge of a kelp blade.



Young starfishes, *Asterias littoralis*, browse about on the surface of a blade of kelp.

ish Isles, the Orkney industry mushroomed and employed some 20,000 people. With the coming of peace, and with other sources of soda and potash once again available, the local industry collapsed and Orkney Islanders emigrated by the thousands to North America. Then came the discovery that kelp is rich in iodine, and there was a second upsurge of kelp-based prosperity. It lasted no longer than the first. Throughout all this period the kelp was actually farmed, and sandy shores were strewn with boulders to provide holdfasts for the marine growth.

Kelp has played another part in human affairs, although it concerns the mind rather than the body, or manufacture. It concerns the theory of evolution, which has changed our way of looking at the universe.

Darwin as a young man went on a five-year voyage around the world, on the *Beagle*, a wooden naval sailing ship sent out to survey coasts and harbors, particularly of South America. Like previous travelers through the Strait of Magellan, Darwin was impressed by the giant kelp growing in those chilly waters. This is what he had to say—"great brown blades growing from inch-thick stems a hundred and more feet below the surface. Almost every leaf is so thickly incrusted with corallines as to be of a white color. We find exquisitely delicate structures, some inhabited by simple hydra-like polyps, others by more organized kinds, and beautiful compound ascidians. On the flat surface various limpets, whelks, sea slugs and some bivalves are attached. Innumerable crustacea frequent every part of the plant. On shaking the great entangled roots, a pile of small fish, shells, cuttle fish, crabs of all orders, sea eggs, starfish, beautiful holothurians, planarians and crawling worms of a multitude of forms, all fall out together . . . I can only compare these great aquatic forests of the southern hemisphere with the terrestrial ones in the inter-tropical regions . . . Amidst the leaves of this plant numerous species of fish live which no where else would find food or shelter; with their destruction the many cormorants, divers, and other fishing birds, the otters, seals, and porpoises would soon perish also."

More than any other experience, I think, this brought home to Darwin both the struggle for existence or for shelter, and the general interdependence of living organisms, plant as well as animal. He had already been impressed, a little earlier on the voyage, when wandering along the shores of the Falkland Islands, by the enormous numbers of eggs that sea slugs had to lay in order to maintain a meager adult population. And when he later added his dawning appreciation of the fact that animals have slowly changed with time and with many generations, the seeds were sown in his mind, to flower in later years as his general theory of evolution.

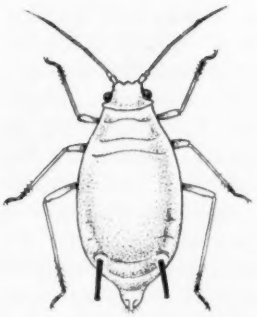
The great kelp beds that lie off the coast of California rank with those of the Strait of Magellan and support a similar wealth of animal life. Even the giant tunas have room to maneuver among the fronds. In either case these shadowy submarine glades of vegetation are too remote and difficult for many persons to explore. Yet anywhere along a rocky shore you can, as a rule, find several kinds of kelp, not giant kelp it is true, but with blades large enough to support innumerable small creatures, and holdfasts so entangled as to give shelter to many others. It is not hard to pull the holdfast from its attachment, and in the tangled mass you will more than likely find small clams and scale worms, young sea urchins, and, above all, brittle stars probing with their five long arms for food. There may be other forms as well, for the kelp may well have taken hold, not on a bare rocky surface, for such surfaces are rare, but on top of barnacles and mussels. (Continued on page 388)

"Bugs"

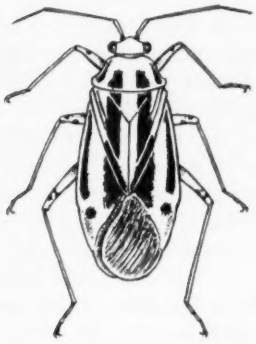
By E. LAURENCE PALMER

Illustrated by Ellen Edmonson and the author

This is the seventy-second in NATURE MAGAZINE'S *series of educational inserts.*



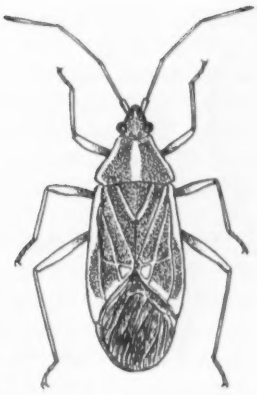
MELON APHID



FOUR-LINED PLANT BUG

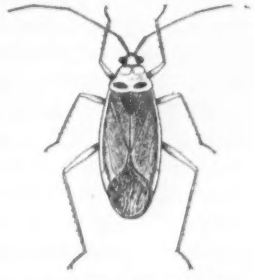
GIANT WATER BUG

COTTONY MAPLE SCALE

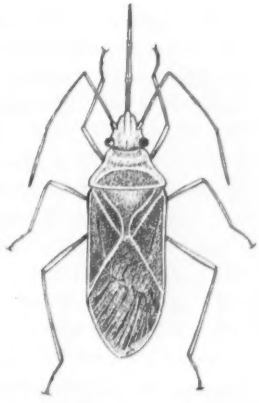


BOX-ELDER BUG

KISSING BUG



COTTON LEAF BUG



COTTON STAINER

Fifty-five years ago this summer I was a ten-year-old youngster having my first experience with cyanide of potassium. I had read in a Cornell University bulletin about making a cyanide jar in which to kill insects. I remember distinctly buying the poisonous stuff at a drug store, the entrance to which was marked by a wooden Indian and two huge bottles of green and blue liquid. Why the druggist was able to sell it to a ten-year-old boy I shall never know, but he did, and I added some plaster of Paris to the cyanide in the bottom of a Mason jar and soon had a killing jar for my insects.

I made a crude collecting net attached to a loop of haywire nailed with great difficulty to a hardwood broom handle, and went collecting insects in a field where now stands the imposing structure of the Cortland, New York, State Teachers College. The first insect I caught I now know was a palmerworm, but I did not know it at the time. Instead, after mounting it, according to directions, with other insects that went into that bottle, I pinned it with great care in a section of a huge, black, pasteboard box. On the outside of the box, with much wobbling of the paint brush, I inscribed the word BUGS in large white letters. To me then, and to many persons now, all insects were bugs. I believe that with a little trying I could name most of the insects that I mounted in that first box, which was the forerunner of a series of cigar boxes that made a stack at least three feet by four feet. Each of these boxes was packed full of pinned insects and eventually each box came to be filled with related insects, so that there were some beetle boxes, some butterfly boxes, some wasp boxes, and, of course, some bug boxes. I think that most of us learn many things this way. We begin with a conglomeration of things, and sooner or later, in self defense, we begin to put similar things together.

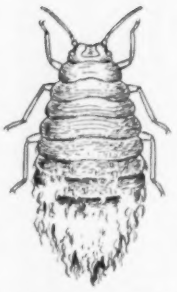
"Bugs" is not a generic name that may be applied readily or properly to all insects, any more than "insects" is a generic name that can be applied not only to insects but to spiders, scorpions and other arthropods. In my *Bible* dictionary, I find scorpions and spiders listed as insects. There, also, I find beetles listed as species of locusts, although what a locust may be is difficult to determine. Is a locust an hemipterous insect, or an orthopterous insect? I fail to find bugs of any kind listed in my *Bible* dictionary, but it is difficult to believe that these creatures did not enter the lives of persons who lived to the east of the Mediterranean. Possibly some of my readers can help me, as they have in the past, to find Biblical references to insects that are really bugs.

At this point you may ask me what I mean by a "bug." When I first studied entomology in college I was told that members of the Order Hemiptera were "bugs." By the time I finished my college training, the Order Hemiptera had been

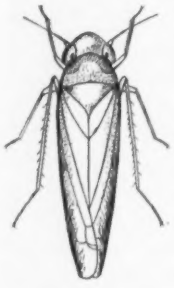
divided into the Orders Hemiptera and Homoptera. I admit that in this insert I have stuck to the old classification, and, as shown in the chart section, have included examples from each group. A glance at the sketches will show that some of these insects, like the box-elder bug, the kissing bug and the giant water bug, seem to have wings that are partly membranous and partly otherwise. These half-wings are in the Hemiptera. The leaf hoppers, aphids and scale insects, which we include as bugs, do not have the half-and-half wings and are considered as members of the Order Homoptera. Members of both groups, however, have sucking mouth parts, and do not go through the larval, pupal and adult stages of such insects as the beetles, flies, butterflies and wasps. Instead, the bugs have what we call an incomplete metamorphosis in which the young stages have at least some resemblance to the adults, usually differing primarily in lacking the full wings of the adults.

In a popular sense some use the term bugs, as when speaking of June-bugs. These insects, of course, are beetles and not bugs. We also speak of being as "snug as a bug in a rug," but whether we refer here to a carpet beetle, or a clothes moth, or maybe a bedbug we do not know. Certainly there are plenty of insects to be found in rugs and not all of them are bugs in the strictest sense. While in our vernacular we put bugs in rugs, ants in pants, and bees in bonnets, we really are not so free in our use of the word bug as we are in use of the word "fly." A "fly" may be, in popular terms, almost any kind of insect. From May-fly to a dragon fly, from a caddis fly to a syrphid fly, from a Spanish fly to dobson fly, we have insects none of which are flies. It is not so easy to find the term bug used erroneously as it is to find abuse of the word fly. A mechanic likes to let an engine run for some time until it gets the "bugs" out of it. When we want to make a suggestion to a friend we may put a "bug" in his ear. When someone goes insane we say that he is "bug house." It is quite probable that in the vernacular the word bug is ordinarily not associated with something that is good. On the contrary it usually suggests something that is undesirable.

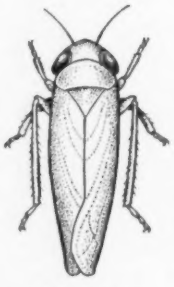
The Geography of Bugs. A glance through the second section of the chart material on bugs in this insert will show that these insects vary in their distribution. Some are relatively limited in their range, while others use most of the whole world as a feeding ground. Where their food organisms are few there is obviously a tendency for the species to be limited to the range of the food. We do not find many enemies of orange trees in the northern States. A glance at the section dealing with food and ecology



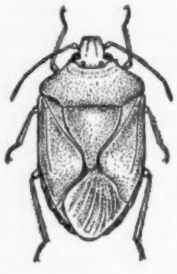
WOOLLY APPLE APHIS



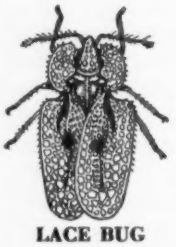
APPLE LEAF HOPPER



BEET LEAF HOPPER



GREEN SOLDIER BUG



LACE BUG

may also be helpful in showing how the range of different bugs may vary. A study of this material will show repeatedly that many bugs may have alternative hosts that they use at different times of the year. Beet leaf hoppers, for example, may winter on Russian thistle, but they move into the beet fields when those crops become available. Other bugs have similar stories, and an appreciation and knowledge of this may be important in managing control. If the alternate hosts can be removed the chance of survival for the bug is naturally decreased.

Just as there are variations in the great geographic range of our bugs, so there are equally definite limitations to be found in any given area. Giant water bugs naturally feed in water where they can swim readily and can capture their favored food. Other insects will favor drier spots, warmer spots, shadier spots than their kin. In the notes on grape phylloxera it is shown that one method of controlling these destructive insects on the roots of grape is to flood the vines and drown the insects while they are underground. On the other hand some bugs may be controlled by removing water entirely from their environment.

Other Bugs in Other Inserts. There may be those who will say that we have not necessarily selected for inclusion here some of the commoner, better known bugs. Chinch bugs, squash bugs, bedbugs and so on do not appear in this insert. As a matter of fact the first insert of the series included such bugs as water striders, water boatmen, water scorpions, smaller giant water bugs among the water insects. We did not like to repeat treatment of them here. In addition to these just mentioned we have seen fit in these inserts not to include ordinarily organisms that are included in Palmer's *Fieldbook of Natural History*, published by McGraw-Hill Book Company. Adding the eighteen bugs here included to the twenty included in the fieldbook, we have thirty-eight bugs handled in this way. The fieldbook bugs, not mentioned in this paragraph or in this insert, include oyster-shell scale, citrus mealy bug, rosy apple aphid, pear psylla, rose leaf hopper, buffalo tree hopper, spittle insect, seventeen year cicada, tarnished plant bug, meadow plant bug and gray damsel bug.

Bugs, Health and Economy. Many bugs are annoying and some really dangerous to man. Riley and Johannsen's *Handbook of Medical Entomology* gives a considerable list of bugs that have been known to bite man. Some of these are included in our insert—the giant water bug, the kissing bug or assassin bug, and even the tarnished plant bug and the apple leaf hopper. The bedbug, of course, is probably the worst known offender in this category. The Chagas'

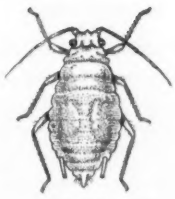
disease, which is often fatal, is carried by the bite of a relative of our kissing bug. In Asia a type of recurrent fever is carried by the bite of bedbugs.

Our bugs have a worse record when we compare their relation to plant health with their relation to animal health. Aphids, leaf hoppers and white flies are the major carriers of virus diseases of plants. Many of these virus diseases cut down the production of the plants enormously, and, in some cases, completely destroy crops. Because of this the economic importance of these insects may be more than that of many species whose only injury to the plants is that which they themselves inflict. Of course, a crop may fail because of a virus introduced by insect injury, or because of an attack of a fungus plant that was able to thrive because the plant was weakened by insect injury. The point is that no one can deny that bugs do wreak great havoc on plants that are of food value, and, therefore, insects are of economic importance to man. Economic entomology has an important place in world economy, and much of economic entomology concerns itself primarily with the control and management of bugs. Chapter 12 of John Charles Walker's *Plant Pathology* should prove informative reading to those interested in some phases of this problem.

Of such economic importance are insects that the 1952 Yearbook of the United States Department of Agriculture is devoted to a consideration of them and the problems they create. These yearbooks are printed in limited editions, and it is not likely that another number on insects will appear again in the relatively near future, so it is a valuable work to consult or own. It is in part because of the appearance of this book that this special insert was prepared.

How Bugs Eat. One of the reasons why bugs manage to do so well by themselves is on account of the way in which they eat. We may cover a plant with a poison that would kill a beetle or caterpillar that chews its food, but it would have no effect whatever on the bug that merely thrusts its piercing mouthparts through the covering of poison and sucks the plant juice that serves as its food.

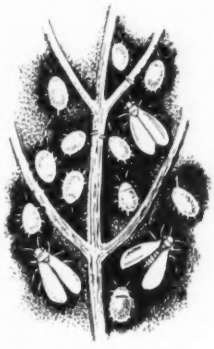
These piercing mouthparts of bugs vary considerably with the kind of food eaten. If some of the insects must feed on the seeds of cotton buried beneath cotton fiber, and enclosed in a leafy covering, the insect must be able to penetrate this cover in order to eat. If the food is an active fish, a bug like a giant water bug must be able to capture and hold to the fish and pierce its skin to get at the juices that are to be food. If the insect feeds on the juices of a woody plant it must be able to penetrate the bark and wood of the stems or roots on which it feeds. To do this some bugs, like the cicadas, must make their way through closely packed earth for considerable distances. Once they have tapped a source of food they may settle down and gorge themselves for a long time. You can read the story of some of the scale insects to understand some of this.



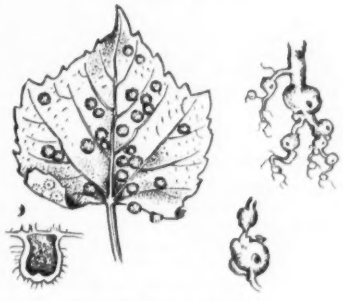
GREEN BUG

HARLEQUIN BUG

NEGRO BUG



GREENHOUSE WHITE FLY



GRAPE PHYLLOXERA

Since many bugs move from one food supply to another between meals, they may help spread virus and some other diseases of plants. Some may do the same with animals, although fortunately this is not common over much of the United States among the animal disease carriers.

How Bugs Breathe. Bugs breathe through pores in the sides of their abdomens. It has been found that if one cannot kill bugs by means of poisoning that they can kill them by preventing them from breathing. Commonly this is effected by using a spray containing soap or oil, or some similar substance that forms a film. If the breathing pores of a bug are covered with such a film the bug cannot get air and so becomes strangled and dies. The problem with this sort of control is to get the spray where it will do the most good and yet prevent it from interfering with the plant, which itself may need air. Since a bug's egg may not need air, as do the other stages in the insect's life, it would be possible for a bug to lay an egg and then die. Some time later the egg would hatch and the new bug would take up where its parent left off. To care for this situation it is common practice to make periodic sprays, one of which will kill the adults and nymphs and the next of which will kill the nymphs that came from the eggs that were left.

Some of the water bugs have interesting ways of breathing. This is particularly true of the water scorpions, which can breathe through a long tube at their rears. These bugs merely extend this tube like a periscope, or snorkel, above the surface of the water and continue to explore under water for the insects on which they feed. Most other water bugs that live under water get their air supply from the rear, leaving their food-getting apparatus free to explore the depths. Most of them get a reserve supply and take it under water with them rather then continuing to breathe through a periscope-like device.

How Bugs Move About. We (Continued on page 368)

NAME SCIENTIFIC NAME	NEGRO BUG *Corimelaena pulicaria*	HARLEQUIN BUG *Murgantia histrionica*	GREEN SOLDIER BUG *Acrosternum hilare*	BOX-ELDER BUG *Leptocoris trivittatus*
DESCRIPTION	Length, about 1/10-inch. Beetle-like in superficial appearance. Hard-shelled, shining black, broader to the front. May rest with legs and other appendages hidden beneath upper parts. May appear in great numbers crowded together in a small area, sometimes appearing like the droppings of other insects.	Length about ⅜-inch. Foul smelling. Flat and shield-shaped, with many gaudy red and black spots formed usually in a bi-symmetric pattern. In adult, wings, when folded, cover 2/3 length of body including the head. Antennae about equal in length to front legs. Adults broadest towards the front.	Length to ¾-inch. Stout green bugs with free tips of wings showing as membranes only 1/3 length of body. Broadest at forward end of abdomen. Edges of head, thorax and abdomen bordered with yellow or red. Last nymph stage ½-inch long, with head and thorax black and orange and abdomen yellow. green.	Length about ½-inch. Brownish black with 3 longitudinal red stripes on the thorax and with red veins in the wings. Flat-backed and narrowly oval in general outline and generally rather neat in appearance. The abdomen under the wings is bright red. Known as democrat bug and populist bug in Kansas and vicinity.
RANGE AND RELATIONSHIP	Order Hemiptera. Family Cydnidae. Found throughout United States and Canada east of the Rocky Mountains. Common on cereal plants such as corn and wheat, and particularly on celery, raspberries and blackberries; on many ornamental flowers, veronica, lobelia and Bidens, and on many weeds. Erratic.	Order Hemiptera. Family Pentatomidae. Essentially a southern insect ranging from Atlantic to Pacific, but rarely in destructive abundance north of 40th parallel. Spread over South from Mexico shortly after Civil War and was believed to have been brought in by Yankee troops.	Order Hemiptera. Family Pentatomidae. One of a large group of destructive bugs. Sometimes listed as *Nezara*. This species ranges throughout the United States and Southern Canada, south to West Indies and Brazil, and in some parts of its range is a serious pest of fruits.	Order Hemiptera. Family Coreidae. The squash bug of the garden belongs to the same family. Box-elder bugs are most abundant in the middle West, particularly where the box elder is to be found in abundance. It may feed on the leaves of ash, maple, or even of some houseplants.
REPRODUCTION	Winter as adults. Eggs, laid singly on leaves, hatch in about 2 weeks into reddish nymphs that resemble adults. Increase in size by molts and by midsummer reach maturity. Breed and feed a few weeks in midsummer, but enter hibernation before any cold weather appears.	May feed and breed throughout the year. May emerge from hibernation with earliest warm weather. Lay tiny, white, keg-like eggs in bunches of about a dozen in double rows on under side of leaves. Eggs hatch in 4 to 20 days and, after 5 stages of development, reach maturity in 4 to 9 weeks. 3-4 generations a year.	Winter as adults, emerging in May. Light yellow to light green eggs laid in clusters of to 50 on leaf. Female lays 2 or 3 batches. Eggs hatch in 1 week and first stage spent near hatching point. In development passes through 5 stages getting wings in the 5th. Mature in 7 to 10 weeks. One generation.	There is one generation, or sometimes two, a year. Adult females that survive winter lay eggs on box-elder leaves in early spring. The immature nymphs are bright red. In late summer and fall reach greatest abundance and then congregate in great numbers, seeking hibernation spots, at which time they may crowd into houses.
FOOD AND ECOLOGY	Secretions of insects give foul taste to raspberries and blackberries, and hosts of insects on many crops suck juices and cause plants to wilt and die, sometimes destroying thousands of dollars worth of celery, for example in Ohio. Insects usually crawl rather than fly. Wings hidden under enlarged shield on back.	Particularly favor asparagus, cabbage, cauliflower, collards, Brussels sprouts, horseradish, kohlrabi, radish and turnip, or, as alternative food, tomato, okra, potato, eggplant, bean, beet as well as almost any garden crop, field crop, fruit tree, or weeds such as wild mustard and amaranth pigweed.	Attacks many plants injuring peach, apple, pear, cabbage, beans, peas, okra, tomato, eggplant, corn, turnip, mustard, cotton and many trees, shrubs and herbs. Because of wide range of food plants is difficult to control. Hibernation is under trash and leaves, usually where it is dry and sheltered.	Cannot injure man or beast by biting, but do have considerable nuisance value when they crowd into houses where they may be crushed against valuable fabrics, or on wall paper, window curtains and the like. May show some response to heat and light. Nymphs may sometimes be injurious to strawberries.
ECONOMIC IMPORTANCE	Control by destruction of infected weeds. Nicotine sulfate spray using 8 pounds of soap with 100 gallons of water to 1 quart of nicotine sulfate. This will kill the bugs hit by it. Fortunately the bugs are not ordinarily common, but unfortunately when they are abundant they may be highly destructive.	May be destroyed by hand picking early in the day, or by dusting with 10% DDT or toxaphene at about 40 pounds to the acre, or by using 2 pounds of 50% wettable DDT to 100 gallons of water, but these must be used before parts useful to man as food have begun to form. In these stages use rotenone dust or spray, or 20% sabadilla.	Contact sprays and hand-picking are the best means of control. The insects are a bit sluggish in movements and are inclined to hide much of the time. They may injure cotton bolls, causing them to shrink and decay, and, of course, ruining the fiber and the crop.	Control is essentially that of spraying insects when congregated in houses or other hibernating spots. In houses the usual insect sprays are effective. In the outdoors kerosene may be used, or use 1 tablespoonful of 40% nicotine sulfate in 1 gallon of water, into which 1 ounce of soap has been dissolved.

Cotton Stainer *Dysdercus suturellus*	Lace Bug *Corythuca ciliata*	Kissing Bug *Melanolestes picipes*	Four-lined Plant Bug *Poecilocapsus lineatus*	Cotton Leaf Bug *Calocoris rapidus*
Length to 3/5-inch. Flattened, narrow, long-legged. Head and prothorax bright red, with remainder of body dark brown with light yellow lines running crosswise. Folded wings in adults cover the abdomen. Adults with long sucking beaks, which can be inserted between leaves that usually protect a cotton boll.	Length about ¼-inch. Conspicuous because of lace-like wing covers and lace-like expansions at the sides of the front part of the insects, with legs and antennae extending beyond edge of "lace" when viewed from above. There are dark mottlings, which add to the lace effect in making these small insects relatively conspicuous.	Length to 1 inch. Head small, narrow, conical. Wings crossed flat on the back and when folded come to abdomen edge, which is extended at the sides into thin plates. Dark brown to black with some pinkish or reddish-brown bar-like markings. Legs and antennae, long and slender.	Length to 1/3-inch. Greenish-yellow with 4 distinct black stripes down the wingcovers on the back. General outline oval with relatively long legs and black antennae. Very active. Nymphs are bright red to orange, with black dots on thorax, and in last stage with yellow stripe on wing-pads.	Length to just over ¼-inch. Relatively slender with wings of adults covering over ¾ of the length of the body. Legs and antennae relatively long. There are distinctive bright red spots near the middle of the wings when at rest. The nymphs are bright green with conspicuous red markings.
Order Hemiptera. Family Pyrrhocoridae. An important cotton pest in Florida and found in some numbers in Georgia, Alabama and South Carolina, but not in large enough numbers to be considered a serious menace. While main food is cotton the insects are also found on other plants.	Order Hemiptera. Family Tingitidae. Some 70 species in Subfamily Tinginae range over eastern States, each being confined to relatively few closely related hosts. *C. ciliata* the sycamore lacebug has been found on ash, hickory and mulberry, as well as being most common on sycamore.	Order Hemiptera. Family Reduviidae. One of the assassin bugs or masked hunters closely related to Mexican bed bugs and so-called China bed bugs and to the masked bed bug hunter. Many of the group frequent dwellings and outhouses. They are more abundant in the South and Southwest.	Order Hemiptera. Family Miridae. A member of a large family of plant-bugs with tarnished plant-bug one of the better known close relatives. It is relatively common throughout area east of the Rocky Mountains, living on many plants, both wild and cultivated, and sometimes being a pest.	Order Hemiptera. Family Miridae. The family is known as the leaf-bug family and is probably one of the families with the largest representation of the Hemiptera in America. Included in the family are the tarnished plant bug, tne red apple bug, the hop red bug, the false red apple bug.
In fall and winter insects congregate in great numbers on piles of cotton seed to hibernate there, or on rubbish. Eggs are laid on plants in early season and the nymphs, that may average 1/3-inch long and show small wing patches, develop to reach adulthood and greatest abundance by August and September.	Winter is passed in hibernation in adult stage. Eggs laid along ribs on under leaf-surfaces in early spring, hatch in 2 to 3 weeks, and in 5 to 6 more weeks develop to mature stage. In the North there are two generations a year and in the South and Southwest there are more. Eggs, cast skins and excrement abundant.	Short-winged adults that appear in the fall hibernate through the winter and, in the Kansas latitudes, become active under trash and stones by April and May. Apparently there is but one generation a year and it follows the ordinary pattern of insects of tnis general type.	White eggs placed in slits in canes of currants and similar plants. Several eggs in one spot but ends stick out. Hatch in May or June into bright red or orange nymphs that reach maturity in about 6 weeks, with one generation a year the rule. Female lays eggs in the fall and may die.	The life history is not well known, but there are several generations a year apparently, and the pattern is undoubtedly similar to that of other members of the family here described. Wing patches appear in the later nymph stages but do not cover half the abdomen in nymphs.
May thrive on cocklebur, nightshade, hibiscus and at times may attack and injure oranges. When the bugs congregate they form conspicuous red patches that may be jarred from the plants and destroyed. The bugs pierce cotton seeds, causing a brownish juice to stain the lint, ruining its market value.	Under sides of infected leaves may appear speckled with insects in different stages, but corresponding upper surface becomes white, brown or deadened in appearance. Winter may be spent under the scales of the bark of the host tree. Eggs may be glued to leaves with brown glue or imbedded in leaf tissue.	Man, domestic animals, poultry and other blooded animals are bitten by these insects. Some cause intense pain, faintness, vomiting and produce effects similar to bites of poisonous snakes the effects of which may last for some months in virulent cases. Related insects are more dangerous.	Suck juices of many plants, including gooseberry, currant, rose and many garden and ornamental plants including woody plants and herbs. New growth may wilt after bug has fed on it. Leaves show white or dark, 1/16- to 1/8-inch spots on upper side and leaves may wilt and fall if infestation is heavy.	Has been reported as a serious pest of cotton since the bite of the insect on a cotton boll may cause the boll to shrink and to decay. Evidence is small black spot, which becomes larger and sunken, giving a diseased appearance. Probably caused by juice introduced by insect.
Control is by destroying host plants, by clearing up rubbish and old plants in which adults may be wintering, by knocking colonies into buckets containing water and a film of kerosene or just hot water. Piles of cotton seeds may be used as traps to attract adults that may then be killed.	Injury to shade trees in times of drought may be severe and control should be begun in spring when young have hatched, and should be repeated at 2-week intervals, application being to under sides of leaves and being of contact insecticide type. May be DDT, nicotine sulfate, pyrethrum powder and like.	Chagas' disease of South and Central America is produced by a relative and may prove highly fatal. Some relatives feed most commonly at night. Some produce almost painless bites. Some feed on other insects. Screening to prevent access is about the only control method suggested.	Difficult to control because of activity but contact sprays are used, such as 40% nicotine sulfate ½ pint with 1 pound of soap in 25 gallons of water, or derris water, or pyrethrum applied in May or June, or dust with 4% nicotine and rotenone dust particularly before adults appear to lay new eggs.	Since so little seems to be known about the insect no special control seems to have been developed. Fortunately the insect is abundant as a pest only locally and at considerable intervals. In severe infestation the cotton bolls may be dropped entirely following attacks.

NAME SCIENTIFIC NAME	GIANT WATER BUG *Benacus griseus*	BEET LEAF HOPPER *Circulifer tenellus*	APPLE LEAF HOPPER *Empoasca mali*	MELON APHIS *Aphis gossypii*
DESCRIPTION	Length to 2½ inches. The largest of the giant water bugs. About ½ inch longer than *Lethocerus americanus*. Front legs fold into grooves in one section in *Lethocerus*, but not in *Benacus*. Front legs capable of holding prey and mouth parts capable of piercing flesh, making a painful wound.	Length about ⅛-inch. Pale green to yellow sometimes with dark patches. Wedge-shaped in superficial appearance. Legs long and slender and useful in making quick jumps. Adults fly readily when disturbed, appearing like minute whitish flies. Cause the disease curly top or blight, which is a serious injury.	Length about ⅛-inch. Pale yellowish-green with 6 to 8 distinguishing white marks towards the forward part of the back. In field may be spectacular when adults jump or fly quickly from badly infested spot. May appear in swarms under such circumstances.	Length about 1/25-inch. Known to some as black aphis or black fly. Wingless female may be yellow, green or black. Winged female has head and most of thorax black and abdomen yellow to dark green. Winged females can fly or be blown great distances. Usually recognized by injury to plant that has leaf edges curled downward.
RANGE AND RELATIONSHIP	Order Hemiptera. Family Belostomidae. May be found on ground under electric lights to which they are attracted. Live in water but migrate from pond to pond particularly during the breeding season. Usually migration of this sort is done at night. Related genera include *Lethocerus* and *Belostoma*.	Order Homoptera. Family Cicadellidae. As suggested in another column the family is one of the large families of the order with thousands of species to be found in America. This species is most abundant in western United States from Canada to Mexico east to Missouri, Illinois and Texas.	Order Homoptera. Family Cicadellidae. There are over 2200 species to be found in this family in the United States and Canada, where they are destructive to shade trees, forest trees, crops of many kinds, weeds and garden flowers. This species thrives on apple but may be on others.	Order Homoptera. Family Aphidae. This species is found throughout the United States south to Central America and South America. Most destructive abundance in the South and Southwest, where it may breed throughout the year. Found on many plants in open or in greenhouses over long season.
REPRODUCTION	Eggs laid in water on trash at edges of ponds in masses to 3 inches long, each mass containing to 100 eggs. Eggs in a single layer attached in more or less definite rows each egg to 1/5-inch long, oval and blunt-ended, brown, streaked. Incubation at least 10 days. Nymphs without developed wings.	Adults may winter on weeds. Egg-laying on beets begins by March and first generation may mature by early May, when adults may fly hundreds of miles establishing new colonies. Eggs hatch in about 2 weeks and generation may last 3 to 8 weeks, with 3 or more generations a year possible.	Winter spent in egg stage. Hatch in early spring and develop through 5 molts to adulthood, requiring about 1 month to reach maturity. With the winged adults the population may spread widely. Second or third brood may migrate from apple to potato. There may be 3 generations a season on potato.	Winged female produces living young at rate of 4 or 5 a day. These young in turn produce other living young when 6 days old. Female may move from leaf to leaf every 2 or 3 days founding new colonies. When food is scarce colonies may be small, but winged or wingless young may be produced at any time.
FOOD AND ECOLOGY	Food definitely living animals, which may be overcome and sometimes including fish to a few inches long. The bite, with its poison, undoubtedly aids in reducing struggles of victim that is attacked. Animals may serve as food for larger animals but definitely control numbers of smaller animals.	Insect may destroy or weaken critically sugar beet crop and may carry tomato yellows disease. Known to attack sugar beets, table beets, mangels, tomatoes, and to thrive on Russian thistle, which may be source of crop infestation. Most severe infestations seem to follow most severe winters.	Besides attacking apple and potato, this pest may cause serious injury to celery, sugar beets and beans, but its greatest injury may be to young apple nursery stock. Injury to all crops is greatest in times of drought when leaves and growing points of plants may wilt and die.	In Texas there may be 51 generations in 12 months, the average female producing 80 young if left to own activity. Males develop in fall in North helping produce fertile eggs, that winter over. Eggs may be found in North on live-forever. Plants attacked include melons, cotton, okra, beets, asparagus.
ECONOMIC IMPORTANCE	Not abundant enough to be of economic importance, but might be injurious in a fish hatchery where young are being raised, and where lights are often used to attract other smaller insects that have a definite food value. These insects should be handled with great care and respect.	Control is by destruction of winter hosts, particularly Russian thistle. Insect actually carries a filterable virus, which causes disease in plant. Wintering adults killed on hosts by spraying 1 to 1½ pounds of DDT to 3 gallons of kerosene per acre. Early planting and cultivation helps in control.	There are many close relatives living on trees such as birch, hazel, walnut, alder, oak, willow, poplar, dogwood, white pine, maples, etc. Best control is contact insecticide applied early in season before adults develop.	Other plants are citrus, spinach and a host of weeds. Control almost impossible by destroying hosts since they are so many. Instead contact sprays and soap emulsions applied in early season and repeated often may keep infestations down somewhat. Ants distribute aphids for honeydew.

GREENBUG *Toxoptera graminum*	WOOLLY APPLE APHID *Eriosoma lonigerum*	GREENHOUSE WHITE FLY *Trialeurodes vaporariorum*	COTTONY MAPLE SCALE *Pulvinaria vitis*	GRAPE PHYLLOXERA *Phylloxera vitifoliae*
Length of wingless female to 1/14-inch. Yellowish-green with a darker line down the middle. Eyes and most antennae black. Winged female has wingspread of to ¼ inch and has brownish-yellow head and the thorax lobes black or dark. Wingless and winged forms found through the year sometimes.	Appear as a white, cottony mass over a purplish plant louse, usually in clusters on bark and branches of trees. May appear like white powder in some stages, or may appear like a bluish-white cotton. Cotton or powdery substance is secreted by the aphid. Adults may be winged or wingless.	Length about 1/16-inch. Four-winged, snowy white, oval, flat. Nymphs smaller and pale green. Most easily recognized by nature of injury, leaves losing vigor, turning yellow, becoming sticky or glazed and supporting a sooty fungus growth. Both male and female may fly.	Appears like crowded, cottony pussy-willows, or cotton puffs, on twigs of woody plants, usually on the under sides of the twigs. Scales are females. Scale appears brownish, about 1/5-inch long with cottony material often coming from one side. Size varies considerably with the host plant. Winter scale may be under ⅛-inch.	Recognized by galls formed on leaves and roots of grape. There are 4 distinct forms of adults, as well as the immature stages. Injury recognized as a rotting of roots, or a yellowing of the foliage, followed often by the death of the host plant. Half-pea-sized galls open beneath, freeing wingless yellowish aphids.
Order Homoptera. Family Aphidae. A serious pest in European grain fields. First recorded in United States in 1882 in Virginia and now established practically through United States and southern Canada but not common in the Northeast. Worst in grain area west of Mississippi River.	Order Homoptera. Family Aphidae. This species is world-wide in distribution. In northern United States may winter as eggs or as immature nymphs, these hibernating underground on the roots of apple trees. Host trees include apple, pear, elm, mountain ash and hawthorn.	Order Homoptera. Family Aleyrodidae. Closely related to grape phylloxera and some aphids, but not in same family. Common infester of greenhouse plants in various parts of the country, and at almost any time of the year all stages of the insects may be found in greenhouses.	Order Homoptera. Family Coccidae. This species is widely distributed through United States and Canada, but is most destructive in the northern part of the United States. The family includes the bugs common on house plants, bark lice and many scale insects, some of economic importance.	Order Homoptera. Family Phylloxeridae. Native of eastern United States, but established in wine-producing France about 1863, with result that by 1884 1/3 of French vineyards were badly infected. Appeared in California about 1874 and is established in Russia, Algeria, New Zealand and South Africa.
Aphids that natch from eggs are all females, which give birth to living young and during lifetime of 1 month produce to 100 young each of which produces living young at 7 days of age. Winged males and egg-laying females produced in fall, and the winter may be spent as eggs in North.	Eggs hatch in spring into wingless females that may be produced in 2 generations until early summer. The winged forms produced spread species to many trees of many species. In summer living young are produced. Fall wingless males mate with wingless females that produce a single egg.	Female deposits over 100 yellowish eggs on under side of leaf by short stalks, often in rings. Nymphs settle near hatching point and remain until adults for about 4 weeks, molting 4 times, spending 28 to 30 days in total time. Remain living as flying adults 30 to 40 days spreading infestations meanwhile.	Winters as small, brown scale on twigs and branches, all being female. With spring eggs are laid in cottony mass, a single female laying to 3000 eggs. Eggs hatch in early summer and nymphs crawl to under side of leaves, where they feed and mature in early fall, mate, and then males die and females hibernate.	Winter eggs hatch with developing leaves and produce a gall open at bottom of leaf. In gall, goes tnrough 3 molts in 15 days and these wingless females may produce 600 eggs in 3 weeks. Eggs hatch in 8 days and there may be to 7 generations a year, some moving to roots after 3rd generation. Winged forms come in fall.
Feeds on all small grains and wild and cultivated grasses. Found on corn, rice, and sorghum, for example. In South may winter as nymphs. There may be to 14 generations a year, and female may either lay eggs or produce living young, but males are produced only in last generation.	Particularly injurious to nursery stock. Some varieties of apples like Northern Spies seem to be resistant. Has as an important enemy a wasp-like parasite *Aphelinus mali*, which has been introduced into many countries to serve as a control and has been known to be effective if established.	Suck juices of many plants particularly cucumber, coleus, begonia, ageratum, hibiscus, geranium, fuchsia, lettuce, solanum and tomato. Nymphs are greenish and often crowded in great green patches seriously affecting leaves and whole of the host plant, sometimes ruining marketability.	This species attacks apple, beech, elm, grape, hackberry, honey locust, currant, gooseberry, Norway maple, poplar, plum, peach, sycamore, sumac, Virginia creeper, willow, and other trees, often killing parts of the hosts or all of them.	Fall winged forms breed and female lays single egg after mating. This egg remains in cane through the winter. Gall injury to leaves affects the quality of the grapes of the season. Forms dropping to ground and attacking roots cause roots to rot and die, thus affecting the crop badly.
Control is difficult but consists of destroying weed hosts particularly wild oats and volunteer oats. Usual contact insecticides and soap emulsions are used in control efforts with varying degrees of success. Burning infested plants, while practised, is hardly practicable.	Nursery stock should be rigidly inspected if moved. Root-infesting forms controlled by dipping nursery stock roots in strong nicotine solution and paradichlorobenzene applied to young tree roots to 6 years old has been effective. Insects on trunk controlled by wettable parathion.	Control by fumigation of greenhouse with hydrogen cyanide, or by aerosol treatment with tetraethylpyrophosphate or parathion. ⅛ to ¼ ounce of sodium cyanide usually sufficient to fumigate 1000 cubic feet of greenhouse, but there should be 3 to 4 weekly treatments. Rotenone used.	Control is largely by spring sprays before leaves start, using miscible oils at about 25% dilution, but such sprays must not be used after leaves have started as they may weaken trees and make them even more susceptible to scale attacks than would otherwise be the case.	Best known control is use of resistant stock ordinarily grafting European canes on native American resistant rootstocks. Sometimes root infestation is controlled by flooding the roots periodically, or by fumigation with carbon bisulfide. When replanting a vineyard, old stock is thoroughly destroyed.

(Continued from page 363)

cannot here review the many ways in which bugs move about. We can only suggest that you will find it interesting to investigate the subject yourself. Many bugs swim, fly, crawl, burrow, float, or are carried by other creatures, or otherwise get about. Possibly the most interesting of all these methods of travel is the way immature cicadas bore through closely packed earth by moistening it to make mud through which they can move easily.

How Bugs Reproduce. The success of any organism depends largely on its ability to reproduce. The meek shall inherit the earth if they have ample reproductive capacity. And while birds, and beasts, and almost any animal-eating creatures feed on bugs of one sort or another, directly or indirectly, there is some reason to believe that, long after most of the animals we now know on this earth have vanished, there will be somewhere a bug that still lives.

Read the story of how the aphids and scale insects reproduce, as shown in our charts, and you will get some idea of what happens with them. Think of an animal one female of which can lay 3000 eggs in a short time. Or think of one with which a female may produce 600 eggs in three weeks and has the ability to produce seven generations a year. Add to this the fact that many of these young animals do not need to find a mate to produce fertile young but merely start producing living young, which may, in turn, produce living young that may or may not eventually produce sexual forms that may mate and lay eggs. No matter what your imagination may suggest as a limitation to mass production, the bugs seem to have been able to side-track it. Eggs, sex, small numbers, limited food, drought, flood, heat or cold—the bugs can meet the situation successfully. Ornithologists may boast that a chickadee's stomach may hold 450 plant lice, but the 451st louse, if left to itself, may produce 80 young and be the progenitor in one year of 51 generations of plant lice. The year's production of plant lice would sound like the national debt.

One cannot consider that it is wholly negative that these insects reproduce so successfully. While they destroy plants and other animals there may be some value in limiting the prosperity of their competitors. This has to be considered to help to form a judgment in the matter.

Bugs in Relation to Other Animals. We have already suggested some of the relationships between bugs and other animals. They provide food for many animals. But some of these relationships are most intricate. Some aphids, for example, cannot, or do not, move readily and if left to their own devices might die in times of drought or excessive heat. These same plant lice may yield a liquid honeydew that is sought as food by ants. The ants protect their source of nourishment by moving the aphids from unsuitable pasture to greener fields. They may even take them under ground and let them feed on the roots of plants. The corn root aphid, which fits into this category, may do much to determine whether a farmer gets a new car or not.

We may have hinted that, by and large, bugs are undesirable citizens. We should not overlook the fact that many bugs prey upon other bugs and in so doing lighten the burden of keeping them under control. Surely, we have bedbugs, but we also have bugs that seek and kill bedbugs.

Taking it by and large, we find in the bugs a source of concern, of pleasure, of admiration, of disgust. We must live with them, and in some cases it would be difficult to live without them. They affect our health, our pocketbooks, our happiness, and are a challenge to our intelligence and ingenuity. When the grape phylloxera infested the grape-growing areas of France it affected the economy of a nation. When bedbugs get established in a house or hotel they affect the economic value of that place. Really, now, is it not worth while to put a little more time into the study of bugs than we can provide for you in these eight pages?

Many readers will wish to delve more deeply into the lives of the insects treated in this article. To that end we will supply a partial bibliography of useful and interesting books. Some of these are out of print and will, of necessity, have to be consulted in the public library. Some are recommended for use in identification, others for the pleasure of reading and the information contained in them

Life and Love of the Insect by J. H. C. Fabre. 1929. The Macmillan Company.

Instinct and Intelligence by R. W. C. Hingston. 1929. The Macmillan Company.

Field Book of Insects by F. E. Lutz. G. P. Putnam's Sons.

The Insect Book by L. O. Howard. 1901. Doubleday, Doran. Important work but out of print.

Manual for the Study of Insects by J. H. Comstock, A. B. Comstock and G. W. Herrick. Comstock Publishing Company, Ithaca, New York.

The Insect Guide by Ralph B. Swain. 1948. Doubleday and Company.

Near Horizons by Edwin Way Teale. 1942. Dodd, Mead and Company.

The Junior Book of Insects by Edwin Way Teale. 1953. E. P. Dutton and Company.

Insects in Your Life by C. H. Curran. 1951. Sheridan House.

A Lot of Insects by Frank E. Lutz. 1941. G. P. Putnam's Sons.

Grassroot Jungles by Edwin Way Teale. Dodd, Mead and Company.

Insects of Western North America by E. O. Essig. 1926. The Macmillan Company.

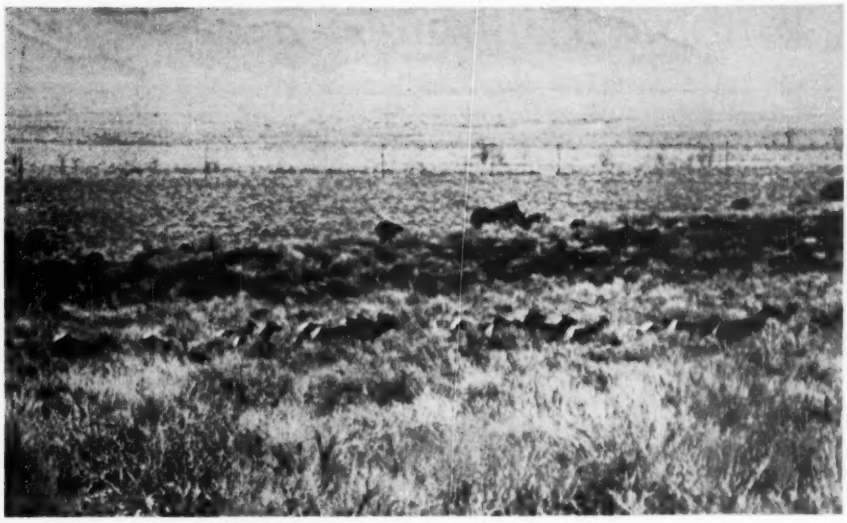
The Gardener's Bug Book by Cynthia Wescott. 1946. Doubleday and Company.

Insects, Their Structure and Life by George H. Carpenter. E. P. Dutton and Company.

Marvels of Insect Life. Edited by Edward Step. Robert M. McBride Company.

Elementary Lessons on Insects by James G. Needham. 1928. Charles C. Thomas.

What of the Tule Elk?



Photograph of Tule Elk by Devereux Butcher

ONE hundred years ago elk roamed the San Joaquin and Sacramento valleys of California in large numbers. When men came, seeking gold, the animals were widely slaughtered, some of them seeking refuge in the tule marshes, whence came the popular name of tule elk. These elk are somewhat smaller and lighter in color than their relatives. Also they are the only valley or plains elk, the other species and sub-species being animals of the high country.

By the turn of the century the march of civilization had reduced the tule elk to a small herd on the large Buttonwillow Ranch between Tulare and Buena Vista lakes. In 1903 the owners of the ranch presented the herd to the United States Government and an unsuccessful attempt was made to drive the elk into Sequoia National Park. Transplantings were made, however, to both Sequoia and Yosemite, but the animals in Sequoia had entirely disappeared by 1926. Those in Yosemite were kept under conditions of captivity. When the National Park Service policy ruled against exhibiting penned or non-native animals, there arose the problem of disposal of the displaced tule elk.

G. Walter Dow, sportsman and business man of Lone Pine, in the Owens Valley, proposed transfer of the elk to that valley. Here was an area owned almost entirely by the City of Los Angeles as protection for its water supply. It was natural habitat for the animals, and there was little agriculture with which they would interfere. So, with the cooperation of the Los Angeles authorities, Mr. Dow constructed a paddock and the elk were transfered in October, 1933. They were held in the paddock and fed for a week, then freed. Mr. Dow bore most of the expense.

There were fifty-three elk involved in the transfer, and they quickly adapted themselves to their new surroundings. A rather optimistic estimate placed the herd at 500, and two open hunting seasons were authorized, reducing the herd to what is now believed to be less than 200 animals. Except for a few in a fenced preserve near Bakersfield, there are no other tule elk save those in Owens Valley.

Careful management of the herd could preserve these animals, but the City of Los Angeles leases some of the land in the valley to ranchers, who resent the elk. Recent pressure from cattlemen has sparked demand by several groups in the valley for removal of the herd. This, of course, aroused Mr. Dow, now virtually retired, and at this writing the elk are still in the valley.

The policy of the California Department of Fish and Game has been recorded as in favor of maintaining the tule elk population at between 125 and 275 animals. The lower figure is regarded by some, including Mr. Dow, as a dangerous low, in the event that some disease should attack the herd.

Cooperating with the Fish and Game Commission, the City of Los Angeles has permitted the use of a considerable area of its property for wildlife refuges. Duck resting ponds have been constructed and plantings made to increase the pheasant and quail populations. Trout-rearing ponds have been installed. The area is ideal for wildlife. The suggestion has also been made that a wildlife refuge be established in that part of the valley between Tinnemaha Dam and the northern shores of Owens Lake. This is a distance of about thirty-five miles, and there are only two moderate-sized cattle ranches in this area.

Perhaps some sort of a cooperative program could be worked out jointly by the California game authorities and the U. S. Fish and Wildlife Service. In any event, no effort should be spared to preserve this remaining herd of native tule elk. Merriam's elk, which once ranged even more widely, has long since been wiped out. Must we run the most obvious risk of adding the tule elk to the sad list of vanished forms of wildlife?

Banished Trailmate

Small, patient plodder of the desert sand,
Your tiny feet accompanied steps of man
On all the weary trails that threaded wastes
Where only in mirage, cool waters ran!

Faithful companion of the trail, and true
Symbolic spirit of the growing West,
You blazed a pathway thankless men pursue;
Pasture is all you ask, cool water; peace;
at trail's end, rest!

—Bessie Berg

Reprinted from *Calico Print* for January, 1953

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Respite for the Burro

By GRACE SHULTS DAVIS

PHOTOGRAPH BY HAROLD O. WEIGHT, COURTESY OF "CALICO PRINT."

The wild desert burros are humble but living symbols of the old West and do not deserve the persecution they have been receiving.

When, in May, Governor Earl Warren of California signed into law a bill prohibiting the shooting of the wild burro, this picturesque little animal of the desert won a respite from wanton slaughter. Under the law the burro is now protected, the year around, for two years. During that period anyone shooting one of the little, long-eared equines is subject to a year in jail, or one thousand dollars fine, or both.

After a period during which the burro was shot for dog and cat food, was used as a target just "for fun," was often killed to serve as food for jaded appetites, public revulsion demanded that this slaughter be stopped. The cruelty involved in year-around shooting, which left many helpless young animals to die when the mothers were killed, aroused many people who saw the evidence of this inhumanity. And many who cherished the burro as a figure in American history and as a part of the desert setting, where he has roamed since the early 1500s, came to his defense.

Various vague and unproved charges had been levelled against the burro by those who found pleasure or profit in shooting it. So demand arose that steps be taken to find the facts about the burro, his numbers, his habits and his relationship to other desert life. At the same time it was insisted that he be protected. State Senators Dorsey, Brown, Cunningham, Hulse, Dilworth, Tenney and Kraft joined in introducing a bill in the California legislature giving the burro respite. This is now law, although a formal study was not approved.

What about the charges that have been made against the wild burro? Is he really an interloper; a trespasser who must be eradicated? Just what are his sins? To what extent is he interfering with the proper balance of other wildlife in the regions in which he appears? How much damage does he do when cultivated fields and orchards border his range?

Originally a native of northern Africa, the burro was early introduced into Palestine and the lands on the northern shores of the Mediterranean Sea. The poetry of the *Bible* sings of the wild ass, and we read of the donkey that carried Christ to Jerusalem on Palm Sunday. Other historical writings disclose the animal in Greece, Italy and Spain. The donkey followed Columbus to the new world, serving the captains and the regiments of Montezuma in his rule of the Aztecs.

This small equine is a creature that can live with man

PHOTOGRAPH BY WILLIAM AND MILDRED ROTTMAN

A group of wild burros in a typical desert setting. The photograph was made about thirty miles south of San Felipe in Baja California.

and serve him well. A burro may develop a dog-like devotion to his master, even standing guard over his grave for a long time. Even after domesticity, however, a burro can adapt himself to the rigors of a wild life and survive as can few other creatures his size.

This little animal has an uncanny instinct for finding water, smelling it out, even underground. The burro has been observed digging his own waterhole with his small, sharp hoofs. It is not at all unlikely that deer make use of the drinking places provided by the intelligent donkey. Yet the burro has been accused of disturbing the watering places of deer and other wild creatures. However, recent studies of water holes shared by cattle, deer and wild burros showed these spots in good condition, and as clean as could be expected.

These water holes were on the open range, are man-made, and called "dug-ways." Actually they are "walk-in wells," made by digging slantwise into the earth, for in the desert water often occurs only a short distance below the surface.

In the May, 1953, issue of *Calico Print*, published at Twenty-Nine Palms, California, Harold and Lucile Weight, editors, reported on long observation of the wild burro, and on research into its habits.

"The wild burros have been with us since the earliest days, " say the Weights. "In California they seemed to select, by choice, the barren hills and valleys—land that no man then used or wanted, or entered except in search of minerals. Here the burro, freed from long servitude, asked only the right to fight the bitter battle of adaption against the most adverse natural conditions. He was victorious, becoming one with the desert land, a familiar and attractive feature on it.

"He did this without interfering with the only other large inhabitants of the desert area, the wild sheep. Just before commercial killers converted hundreds of burros into dog and chicken feed, when the burro population was at its peak, E. H. Ober made an investigation, results of which are published in *California Fish and Game* Magazine, 1931. He reported: 'There seems to be now just about as many mountain sheep in California as there were 30 or 40 years ago, and in the opinion of this writer, their number will continue to be about the same from year to year.'

"In 1937, Joseph Grinnell eminent California zoologist, reported to the California Academy of Sciences: 'Perhaps the only non-human restrictive factor (on the wild sheep) in this region (Death Valley) is the Golden Eagle.' And Ober declared: 'Always the sheep are combating the destructive Golden Eagle. Unfortunately, their favorite delicacy seems to be the young lambs of mountain sheep.'

"'This reiterated charge that the burro has an adverse effect upon wild sheep is the means by which conservation-minded individuals and groups have been jockeyed into support of a year-round open 'big game' season. Actually game officials do not know whether the sheep

The mothers of these orphaned burros had been shot by "sportsmen" and were found wandering, half starved, in the desert by Sara Kirk and her brother Billy. Melinda, the smaller one, had to be bottle-fed for weeks before her life was saved. They became household pets for the care of which the children are responsible.

PHOTOGRAPH COURTESY OF THE TRONA (CAL) ARGONAUT

population is increasing or decreasing. They do not know how many wild burros there are. No census of sheep or burros had been taken for a dozen years when this campaign against the burro opened. There is no evidence that burros have caused the death of a single sheep. On the other hand, in identical sheep-burro ranges in Nevada and Arizona, wild sheep have so increased that annual open seasons *on the sheep* are now held.

"Do wild burros foul water holes and drive off mountain sheep and game birds? Burros, range cattle and horses *all* foul open water holes and springs. Cattle are the worst offenders and since there are infinitely more cattle than burros, their damage is tremendously greater. In a wild sheep survey published by the California Department of Fish and Game, 1938, Joseph Dixon and E. Lowell Sumner, Jr. reported damage by burros and horses and also wrote: 'We found that both of the Dodd Springs (in the Death Valley area) were overrun by a herd of 17 domestic cattle, which trampled and polluted the water so bighorn had ceased to drink there.'

"It would seem more sensible to build watering facilities which could not be polluted than to kill all the burros and remove all the cattle from leased public domain . . . to cure this situation."

In the early days of "winning the West" many a prospector lived to tell of his experiences only because his faithful burro led him to water. In an article entitled "The Real Winner of the West" in the May, 1929, *Touring Topics* (now called *Westways*) H. H. Dunn wrote as follows:

"We read a great deal of Coronado and DeAnza; Jedediah Smith and Kit Carson. We are told of the pioneers from beyond the Rockies and south of the Rio Grande, who made the West safe for hot dogs, canned tomatoes and balloon tires. But we are given no word of the little fellow who made possible the pioneer, corralled the Indian warrior, carried the gold with which the Civil War was won, and today makes livable the Great American Desert."

He states further: "Virtually every water-hole in the desert covering the three thousand miles from the Vale of Anahuac to the Snake River is known to man because a burro found it. Practically every important mine between Guanajuato on the south and Denver on the north, the Mississippi on the east and the Sunset Sea on the west, owes its discovery to the assistance given man by the burro.

"It is doubtful that New Mexico, Arizona, Colorado, Nevada and even parts of California, could have been what they are today had not the burro seen them first. He made it possible for man to find their deposits of gold and silver, and then packed in the water and food by which men worked them; he carried the wood, nails and glass for the first houses, and he packed out the valuable ores, each load half the equal of his own weight.

"Piece by piece, he took agricultural and mining machinery and farm implements into the mountains of the coast and remote places of the desert. On his back were borne the Bible and the textbook so that churches and schools might rise amid the 'leagues of cacti and sand and stars'."

So strong was our desire to investigate the situation of the burro in the desert region, on the edge of which we live, that we decided to start off one bright morning on a tour of inspection. Over San Gorgonio Pass, through Beaumont and Banning and Whitewater, by-passing the glamorous Palm Springs area, we turned toward Morongo Valley and Twenty-Nine Palms.

We found the peace of the desert there. Pure, quiet, sage-scented air refreshed us. Long-eared jack-rabbits loped gracefully among the sparse vegetation across a desert floor streaked with the long shadows of early morning. Cottontails stood at quivering attention until our lumbering forms moved away. Cactus wrens were already busy with nest-building. Desert sparrows rendered dainty bits of song from waving ocotillo switches. Little gray lizards twinkled across our path. Horned lizards moved so rapidly that they seemed to be sliding, stopping suddenly, rock-still, with tiny specks of eyes flashing on and off.

We drove on until the beauty of the morning was marred by the dead body of a wild burro; a jenny; a young mother. Beside her body a spraddle-legged baby stood in rigid bewilderment, long ears scarcely twitching, eyes solemn and frightened. The little fellow was white and he was pretty, wearing a baby bunting coat of fuzzy, woolly softness. Our hearts went out to him in pity. How could he know that certain agencies had outlawed him. Like an innocent little "illegitimate" child he was a criminal after the fact, just by being. If he should by some miracle manage to survive the milkless days of a motherless babyhood, bobcats and mountain lions, he would be destined to meet a deer-rifle slug sooner or later, even as his mother had. He might be ground up for dog food, or perhaps his carcass left lying there after having served as a target for some trigger-happy hunter who had run out of signs to shoot at. He would not, then, even have had the protection of a closed season. Here was a creature without a place in the world, we thought, doomed unless legislation could be put through rapidly enough to save him. Surely he was entitled to a fair trial before the jury of public opinion and the judgment of informed persons.

PHOTOGRAPH BY WILLIAM AND MILDRED ROTTMAN

A quite young burro in the foreground, unafraid of the camera, its mother watching. In the Arizona desert.

Burros laden with all the equipment of the miner. Such animals as these made possible the winning of the old West.

PHOTOGRAPH BY ADELAIDE ARNOLD, COURTESY "CALICO PRINT"

Looking into the intelligent eyes of that helpless baby burro, however, we realized that the little fellow's most immediate problem did not concern his legal status. He needed a substitute for the food, love and security that had been so suddenly snatched from him.

We knew a boy and a girl who would love him, bottle-feed him through his baby days and raise him to be a pet and a willing mount for hours of pleasure. So we bundled the youngster into the back of the jeep and carted him to the desert homestead where the boy and girl and their parents lived. Here he was welcomed with open arms and the promise of a happy future.

But what of those others of his species who have been subject to a reign of terror and wanton destruction? It is impossible to condone the wholesale slaughter of a creature so endowed with historical heritage as is the donkey.

Furthermore, the burro is picturesque in the wild state. That is where he really belongs. Anyone who has observed the burro, either singly or in a small herd, race with the fleetness of antelope, tiny black hoofs flying across the solid desert floor and the rocky hills, must agree that his birthright is the wild places. Where the donkey made his mistake was in ever being faithful to man; in ever submitting so docilely to capture and servitude. He did not ask to be transported in Spanish galleons from his native habitat to the vast desert spaces of the New World. But once here, he happily adapted himself with stamina and remarkable intelligence. It would seem that so extensive an area as the Great American Desert is big enough to accommodate even several thousand of his species, let alone the really few who roam there.

George M. Crosier, general manager of the Society for the Prevention of Cruelty to Animals in the Los Angeles area, recently made a trip out into the desert region near Death Valley to investigate reports of the ruthless killing of the wild burro. Mr. Crosier was accompanied by Dr. Wesley Young of the American Humane Association. They reported in the *Los Angeles Times*.

"Wanton slaughter of tiny wild burros in California desert and mountain areas," the article said, "has reached such proportions that the Society for the Prevention of Cruelty to Animals is pressing for pending legislation [now passed] to protect the scraggly little creatures from trigger-happy hunters.

"One 'killing ground'—Homewood Canyon, which is in rugged territory near Trona, about 240 miles northeast of Los Angeles— recently was investigated by humane officials after reports of massacre of burros there were received from inhabitants of the area.

"Carcasses of these burros were strewn on the scrubby soil in widely separated spots. It was obvious that many of the burros were very young when killed. Further examination showed that in most cases the skulls had no bullet holes, confirming what inhabitants had told us—that hunters had left many of the burros wounded, but not dead.

"Shells from many different caliber guns were found all through the canyon, and there is nothing else there to hunt. 'Over an area of about 50 acres, we found at least 50 carcasses,' declared Mr. Crosier, 'which should give you some idea of the slaughter'."

Numerous ranchers, in sections bordering the badland and desert areas where the burros roam, have been questioned as to damage to orchards and/or crops by burros. Those interviewed were from widely spread regions. Invariably the answer was the same; "No damage. There just aren't enough burros around."

The burro has now been reduced to numbers threatening extinction. It is plainly evident that legislation to protect the animal was necessary. Under protection the herds may increase to an extent warranting some sort of control. If so, a regulated "open season" could be established as a measure less terrible than the present deplorable all-year shooting of the creature.

In the early 1900's herds of four and five hundred fleet-footed wild burros were reported. They were reduced by the 1920's to forty or fifty in a bunch. Now, in the 1950's, no more than four or five are ever seen together, and this only on rare occasions. Desert travelers today can cover numberless miles without spotting a wild burro. Mr. and Mrs. William Rottman of Yucaipa rode in a jeep over southern California, Arizona and New Mexico, and one hundred and fifty miles below the Mexican border, before sighting more than two burros grazing together.

There is another point and that has to do with esthetic and spiritual values. In this fast moving "Atomic Age," mankind is desperately in need of a retreat for his soul in the unspoiled "wild places." In the forests and mountains and non-desecrated valleys, in the wide stretches of sweet-smelling desert where the handiwork of the Creator is left unmolested, mankind can preserve his own peace of soul and an assurance of the all-rightness of things. The more we can leave Nature to adjust her own balance, taking a minimum of the killing of innocent wild creatures upon ourselves, the greater will be our moral and spiritual satisfaction.

Perhaps we should heed a poetic picture from an old, old source—Psalms 104:10,11:

"The Lord sendeth the springs into the valleys that run among the hills. They give drink to every beast of the field. The wild asses quench their thirst."

Ice Cream Sunday

By RAY ROMINE

Take two dips of purest sunshine,
Add an even spread of blue;
Sprinkle on a bit of birdsong,
Or a dab of mountain dew;
Then the fluffiest of white clouds —
Pile them higher, without stopping.
Any day, however perfect,
May yet be improved with topping!

Lost Rivers of Nevada

By NELL MURBARGER

". . .That even the weariest river winds somewhere safe to sea."

As a weaver of words, Swinburne may have been a genius. However, neither poetic philosophy nor their own "weariness" can alter the fact that not all rivers find eventual haven in the sea. Most particularly is this true of Nevada rivers.

In the entire Sagebrush State, the only important waters that ever glimpse the Pacific are those of the meandering Muddy — a tributary of the Colorado — and the Bruneau and Owyhee, rising on the State's northern border and flowing to the Snake and the Columbia. All other rivers of Nevada are doomed to melancholy graves in alkaline lakes, devoid of outlet, or in the great barren catch basins of the interior.

Above, standing water in Humboldt Sink reflects the clouds of June, but by September there is nothing but a vast alkaline waste like Carson sink at left.

Largest of these "sinks" as they are known locally, are the two formed by the dying waters of the snow-fed Carson and the storied Humboldt.

During spring and early summer, when melting snow in the mountains brings to these rivers a period of high water, their generally arid sinks are temporarily replaced by great shallow lakes in which every transient puff of cloud and changing tint of sky is flawlessly mirrored. Such lakes afford temporary haven to gulls and other waterfowl, and the stunted saltbrush along the shores becomes a nesting site for avocets and killdeers.

As winter's snow-pack disappears from the high elevations, and river flows shrink to a trickle, these desert lakes gradually fade away; and where June's blue sky was mirrored and seagulls flew, September finds only vast alkaline wastes of glaring white, devoid of life and dry as mummy dust.

To covered wagon emigrants of the middle 19th Century, the merging sinks of the Carson and Humboldt constituted the dread "Forty-mile Desert," where oxen and horses died from thirst and exhaustion, and men were sickened by the stifling clouds of alkali churned from the basin floor by hoofs of their animals.

Elsewhere in Nevada are many lesser sinks, but none so fearsome to contemplate as this great sprawling waste where the crystal waters of the Carson and the wide Humboldt reach the end of their earthly course.

★

Impartial

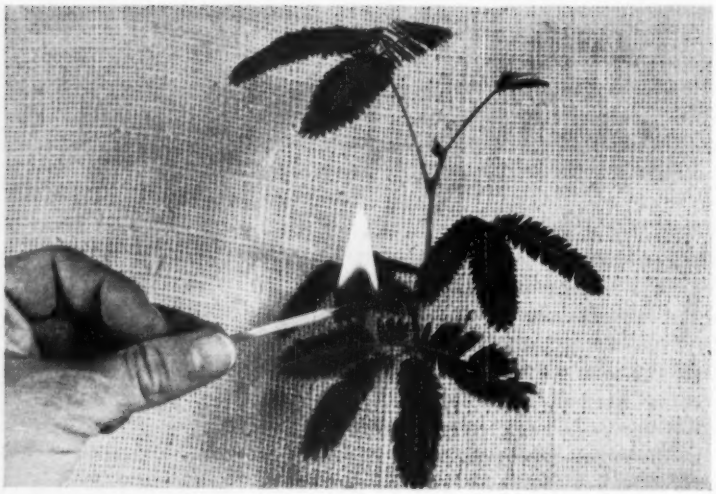
By ELIZABETH MOORE TRACY

Exquisite snow lace
Rests upon a tattered sleeve
As on an altar.

The Sensitive Plant *Is* Sensitive

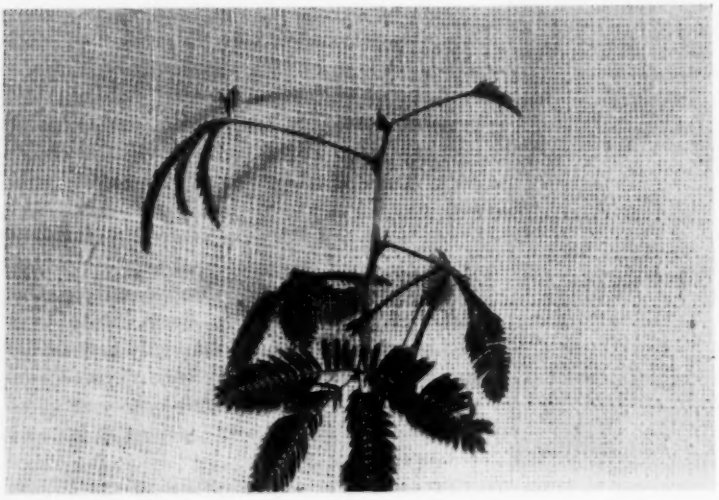
By MYRON R. KIRSCH

Photographs by the Author



The uppermost leaf is stimulated by heat and the leaflets quickly (below) respond by folding. Note the progressive folding in pairs, since the stimulus is severe. At the bottom of the page the stimulus is transmitted to still lower leaves, and, on the opposite page all leaves are collapsed. Recovery will take at least fifteen minutes.

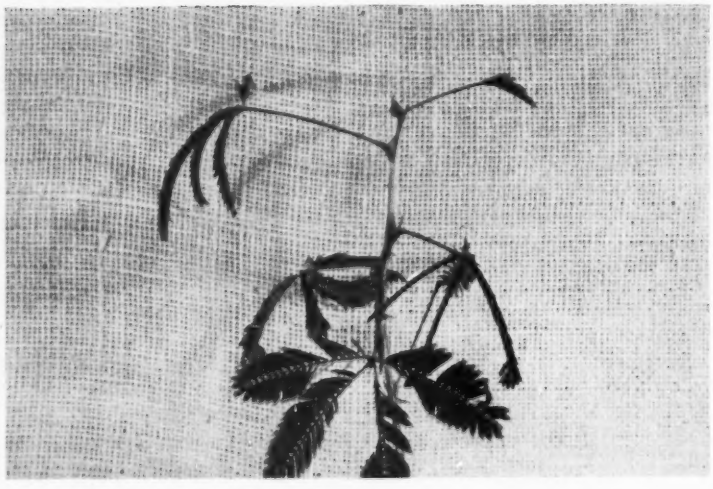
AMONG Nature's array of botanical oddities, few are as baffling as *Mimosa pudica*, the sensitive plant. Hold a lighted match near it, slap it, expose it to ether or chloroform, and it responds in a most spectacular manner. The leaflets fold in pairs, first one pair then the next, until the entire leaf collapses. If the stimulus is moderately strong, other leaves may be similarly affected; while a severe concussion usually causes all the leaves to droop almost simultaneously.



At first glance one might suspect that the sensitive plant possesses an animal-like nervous system. In fact, when the plant first received attention some years ago this suspicion was quite common, even among botanists who professed knowledge of the plant. However, with the passing of time, careful tissue analysis and much experimentation revealed not an animal-like nervous system but a unique water balance mechanism, which at least partially accounted for the plant's uncanny behavior.

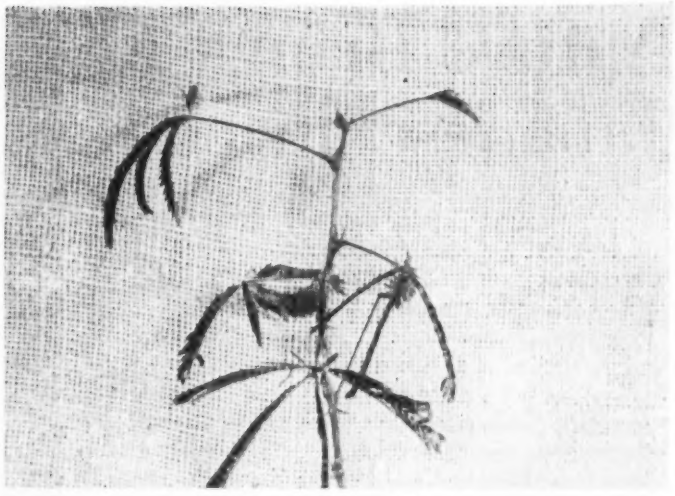
If you were to examine the plant carefully, you would note a swelling at the base of each leaf stalk and leaflet. These swellings are called pulvini (singular pulvinus), and are composed essentially of spongy tissue. When this tissue is in a turgid condition, that is, filled with water under pressure, the stalks and leaflets are in extended positions. When the plant is stimulated, as with heat, certain cells in the pulvini lose water very rapidly, causing these cells to collapse. In a stalk pulvinus, for instance, the cells in the lower half lose water, while those in the upper half gain some and expand. This disturbance in water balance causes the stalk and leaflets to droop, as shown in the photographs.

The response occurs within one-thir-



teenth of a second after stimulation and, at summer temperatures, proceeds at a rate of about an inch and a quarter per second. Recovery is much slower, taking as long as fifteen or more minutes, and occurs as the cells in the lower part of the pulvini reabsorb water and again become turgid.

Inevitably the question arises, "But how is the stimulus transmitted?" Various explanations have been advanced, but each has its shortcomings. Some botanists believe that the irritated cells release a substance, possibly a hormone, which diffuses through the tissues, bringing on the response; while others say that diffusion of a substance is too slow for the response that occurs. Still others conclude that, because the excitation may be transmitted through dead tissues and through cut stems whose ends are connected by water-filled glass tubes, the chain-like reaction is sustained solely by changes in hydrostatic pressure. At best it can be said that the factors affecting the water balance mechanism in this curious plant are rather poorly understood.



Mimosa pudica belongs to the Pulse family and occurs as a low, somewhat shrubby growth bearing numerous hairs and spines. Although native to tropical America, it is widely naturalized in warm countries, where it usually grows as a weed. In some countries, especially the United States, it is often cultivated for and by those who enjoy experimenting with plants, particularly odd ones like this.

One experimenter went so far as to show that *Mimosa pudica* leaves do more work when they are "exercised." He attached weights to drooped leaves and then increased the weights each day until at the end of a month the "exercised" leaves lifted, upon recovery, weights forty percent greater than those not exercised, which leads one to query, "How baffling can a plant be?"

Back-Yard Owls

By MARGARET GROSS GRIEBE

In our back yard, in an over-sized bluebird house, lives a screech owl. When dusk approaches he looks out the entrance until it is dark enough to begin his nightly hunting.

We look out of our window at him, too, or even walk over under the shagbark hickory where his house is hung, fifteen feet up on a hook screwed in the tree trunk. This gives him a better look at us, but it takes a lot to disturb him enough to make him pop back from his window.

More people should invite owls to share their back yards, but we just do not think of owls as good bird house prospects. The house should have an opening hole three inches in diameter. The box should be eight by eight by eighteen inches. The top should open on hinges so it can be cared for, a layer of shavings should be put in the bottom.

Just before it gets too dark to see, our owl comes out and sits on a twig near his doorstep. Then usually another screech owl, the mate, comes along and they fly off together. We do not know where the other owl lives but it is probably the male bird, although we always speak of the one in the house as "he."

It is interesting to look for the tree or post where the owl eats his kill. It is easy to find for pellets lie about on the ground. An owl is a good, automatic mouse trap. Another advantage in having owl neighbors, is their year around tenancy. The southland holds no lures in autumn for our guest in the nest box.

Nature Brings A Japanese Friend

By WELDON D. WOODSON

WHILE reading the May, 1950, issue of *Nature Magazine*, I found a statement that 18-year-old Kazuyoshi Fujita of Fukuoka City, Japan, wished to correspond with amateur entomologists in the United States. Interested in Nature in Japan, I promptly wrote him, and we have been exchanging letters ever since. Not only have I learned much about Nature in his homeland, but Kazuyoshi and I have become real friends.

The young man's father, an employee of the Nishi Nippon Press Company for more than forty years, together with his mother and married sister, the only other child, have encouraged him right along in his avocation of Nature study. They call him by his nickname, Oshyo. There are two methods of pronunciation in Japanese. By the more correct one, his name is pronounced Kazuyoshi; the other method, Oshyo. The latter means priest. Good-naturedly, Kazuyoshi confesses that he possibly is a bad priest, for he has killed many insects. Japanese school pupils give nicknames to their teachers, based upon their habits or appearance, such as red dragonfly, white monkey, crow and bantam hen.

Attending Southwest High School in Fukuoka City, when I first met him by mail, Kazuyoshi was an enthusiastic member of the Fukuoka Biological Lovers Association. It meets at various times throughout the school year, and the hall is invariably packed with the general members (underclassmen) and special members (seniors). The president, or an honorary member (a university professor and celebrity), will give a lecture on birds, let us say, followed by two or three addresses by other honorary members on fishes, plants or other subjects. The session ends with several general members telling of their studies. Like the others, Kazuyoshi would bring his lunch and inevitable notebook.

The young Japanese first began observing insects when ten or eleven years old. During the war, however, his interest in them waned. For a year or so after the war his mind was so confused, and he became so low in spirits, that the great world of natural life about him offered little inspiration. But at school he met Mr. Takemasa Osada, a teacher of biology, who reawakened in him enthusiasm for the teeming insect life in his neighborhood.

Fukuoka City, with a population of some 380,000 people, is surrounded by thickly vegetated hills and mountains—Mt. Hirao, on which grow hundreds of native cherry trees; Mt. Wakasugi, concerning which

Kazuyoshi Fujita of Fukuoka City, Japan, equipped with net and carrying case for an insect hunt.

Kazuyoshi has made a list of its weevils; Mt. Dazaifu, in the vicinity of which his mother was raised. These mountains comprise his favorite insect hunting grounds. Since becoming a full-fledged amateur entomologist, not a season passes without his hiking over at least one or two, and often all three, of these mountains. As an indication of the amount of time he spends afield from the middle of April until the end of May, he went on eleven trips and collected seventy species.

In making his trips, he carries a net, and a satchel strapped over his shoulder. Botanists use this latter to hold plant specimens. For Kazuyoshi, however, it is convenient for his lunch, poison vials and sketch book. If the collecting area is not too far away, he walks the distance, otherwise, he travels on the suburban tramcar.

Mt. Dazaifu, for instance, lies approximately ten miles east of Fukuoka City. "The scenery through the tramcar window," he writes, "changes with the seasons —yellow to green and with the ripening of the rice in the fall, golden yellow again." On the hill slopes he continues to tramp with an eye for tiny insects. At the same time, he does not overlook the many other natural beauties around him. On this hill, where was once his mother's home, thrives the camellia, a single tree of which may bear flowers of three different colors—white, red and rose. Incidentally, the Japanese extract from

the seed of camellias materials that go into the making of a hair oil for women.

Actually, Kazuyoshi says that he does not have to venture from the yard of his parents' two-story dwelling to enjoy Nature. About the house are a wealth of trees, Japanese yellow roses and a profusion of dahlias. In fact, the family farms a little field of dahlias. At the close of the season, they dig up some of the tubers for themselves; others, they sell to the florists; the remainder are given to neighbors.

One of Kazuyoshi's favorite insect hunting grounds, Mt. Hirao, near his home of Fukuoka City.

Lightning bugs abound in his yard in season, a variety of species of cicadas and spiders of one kind or another. One spider, which the Japanese call *ie-gumo*, fashions its web in the corners of rooms between spring and fall. Since it possesses longer legs than many spiders, people are especially afraid of it, although it is harmless.

One species of spider, *Atypus korochi*, constructs its abode along the stones, building from the ground up, in the Fujitas' back yard. Kazuyoshi has observed their nests. "Most are in the shade," he said. "These are shorter than those in the sun. A nest consists of rubbish, soil and the spider's thread. The spider weaves a long sack and fixes rubbish and soil around it. The longest sack is about 260 mm. and the biggest diameter is about 18 mm."

In the spring Kazuyoshi keeps freshly cut flowering peach branches in a vase on his desk of his room. His windows face to the east and west, and the wind blows from the east in the morning, the west, in the evening. His bookcase holds many much-used volumes. From his well-thumbed copy of *The Manyo-shu*, edited in the eighth century, he has quoted me from Prince Yuhara "On Crickets":

> The evening moon shines—
> Here in the garden white with dew
> The crickets sing, alas!
> Burdening my weary heart.

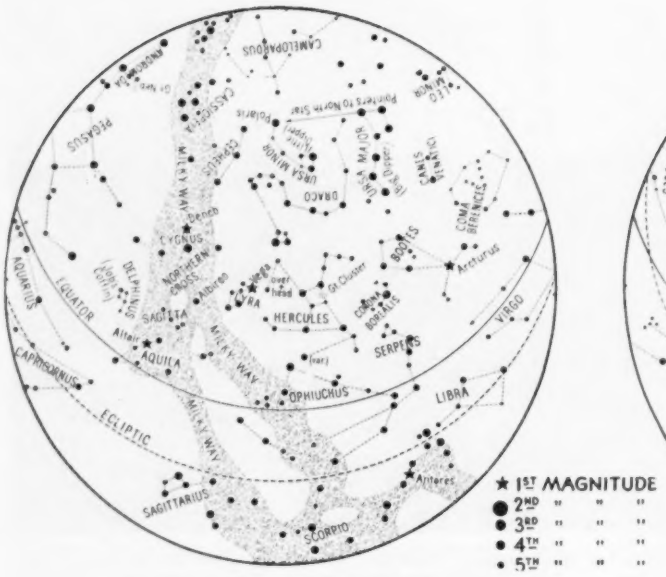
Though we are of different race and nationality, and with the wide Pacific separating us, Kazuyoshi and I feel a oneness because we have in common a fondness for Nature, which is a strong bond between many persons.

★

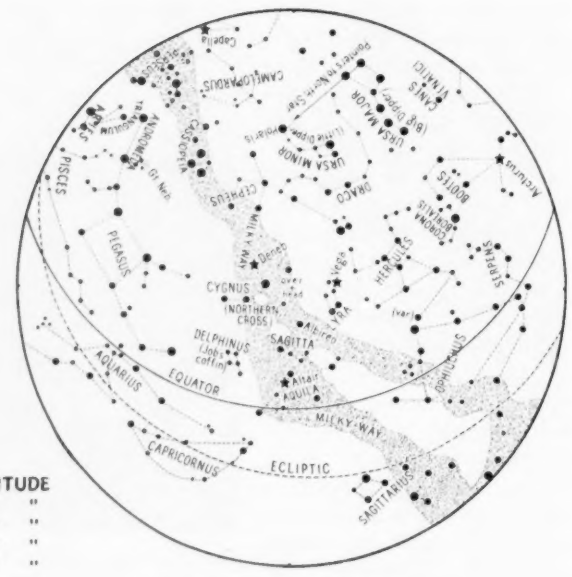
Iowa Boy's Recollection

By OSCAR OSTLUND

Around the slough I used to hear the whistling plover,
Until my father drained the swamp to raise more clover.
He used the finest seed, including timothy,
And when the crop, on that rich loam, grew up,
It was prolific, and it crowded out the prairie buttercup;
And birds — their music ebbed. Less often did we
Hear the hovering rhapsody of the bobolink, or the redwing's *o-ka-leeee*.
O, I do wish that slough had been permitted to remain,
To harbor beauty; and exempt me from the strain
Of pitching loads and loads of tangled hay
On that *converted* playground where the blue flags in gay
Colors, and the bull rush and the slough-life had full sway;
But all that has been altered now, since progress came to *Ioway*.



9 P.M., Aug. 1; 8 P.M., Aug. 15



9 P.M., Sept. 1; 8 P.M., Sept. 15; 7 P.M., Sept. 30.

To use these maps hold them before you in a vertical position and turn until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south. Times given are Eastern Standard.

August and September Skies

By ISABEL M. LEWIS

THERE will be much of interest to observe in both the early morning and the evening sky during these two months.

The Perseid swarm of meteors appears every year in August during the first three weeks, and should be seen this year under specially favorable conditions around the time of its maximum display, after midnight on August 12. New Moon occurs this year on August 9; so there will be no moonlight to dim the brightness of these swiftly moving streaks of light, small, dust-like particles heated to incandescence through their encounter with the earth's atmosphere. Our planet encounters this swarm "head on" on its advancing, or morning side. The members of the Perseid swarm are widely scattered along their orbit. They travel in the same orbit as the comet known as Comet III, 1862, which intersects the ecliptic nearly perpendicularly. As their name indicates The Perseids appear to come from the general direction of a point in the constellation of Perseus, from which, as a matter of perspective, they appear to radiate in all directions, although they actually travel along nearly parallel lines. This point, known as the "radiant," always bears the name of the constellation from which the particular swarm of meteors appears to come, or of a star in the constellation near which it lies. Some rapidly moving meteors such as the Perseids, are met by the earth "head on.' Others, relatively sluggishly moving, have to overtake the earth. In number there are fewer of the latter, and they are reddish or yellowish in color. Meteors that meet the earth on its morning side move rapidly, and are white or bluish in color and more brilliant.

If one intends to look for meteors, it is interesting to keep count of the number seen in an hour, record the constellation or part of the heavens where first seen, the direction in which moving, length of time observed, and color and brightness of the object. For viewing, a location should be chosen far from city lights, preferably in open country or on the water where a clear and unobstructed view of the heavens in all directions may be obtained. In the case of the Perseids—although they may be seen in fewer numbers before midnight and at any time up to about August 20, some even appearing late in July—one will have the best luck well after midnight when Perseus is high above the horizon, and on August 11, 12, 13, preferably on the middle date. There are always some meteors observed during these times that are "sporadic" meteors, not members of the swarm, but they can usually be recognized as not of the same type, coming from another part of the heavens

and different in color or other particulars.

This is the time of year when a portion of the Galaxy, or Milky Way, as it is more popularly called, arches diagonally across the heavens in the evening hours from the northeast toward the southern horizon. In the constellation of Cygnus, The Swan, which lies along the path of the Milky Way and passes overhead in the mid-latitudes of the northern hemisphere early in September, about nine P.M., one may see some of the densest star clouds and most intricate structures in the Milky Way. Here it divides into two distinct branches; the eastern and brighter branch passes through Aquila and Scutum to Sagittarius, and the fainter, western branch goes through the large constellation of Ophiuchus to Scorpio, where the two meet again in one stream. This long, dark rift in the Milky Way between Cygnus and Scorpio represents, it is believed, a vast region consisting of dark, obscuring matter that conceals regions lying behind this veil. It would be similar, probably, in composition to the dark matter, often referred to as dark nebulas, existing in the so-called "holes" and dark patches occurring elsewhere in the Galaxy in Cygnus, Sagittarius, Scorpio, Crux, and in other regions of the vast heavens.

The brightest star in Cygnus, Deneb, one of the 20 brightest in the heavens, lies in the tail of The Swan, and also marks the position of the top of The Northern Cross, now passing overhead in our latitudes about nine P.M. early in September. Albireo, or Beta Cygni, lies in the head of The Swan and also at the foot of The Northern Cross. It is a star of third magnitude and is a beautiful blue and yellow double star, one of the finest in the heavens for small telescopes. At the intersection of the upright and crossarm is the second magnitude star, Gamma Cygni. At the eastern end of the crossarm is the third magnitude star, Zeta, and between this star and Gamma Cygni is the bright 2½ magnitude star, Epsilon Cygni. At the western end of the crossarm is Delta Cygni, a third magnitude star. This configuration of six stars in Cygnus, all of which are of third magnitude or brighter, and which lies entirely within the path of the Milky Way is known to us as The Northern Cross. It is a long and straggling group and cannot be compared in beauty, splendor, or fame with that compact little group in the southern hemisphere, also in the Milky Way, known as Crux, or The Southern Cross. It is, however, one of the well-known configurations in our northern skies and one that should be familiar to all who become acquainted with the most interesting objects in the evening skies at this time of year. It is easily found as it follows directly after the brilliant Vega in the small constellation of Lyra, which passes directly through the zenith in latitude 40 degrees north latitude about nine o'clock in the evening on August 20, (Standard Time).

An interesting phenomenon, worth rising early to see if the skies are clear in the east before sunrise on August 23, occurs when Mercury will pass south of Mars in close conjunction. The two will be separated by an angular distance of only 6 minutes of arc at the time, appearing almost as a close double star. Mercury will be a brilliant object of minus 0.9 magnitude, which is the same as that of Canopus the second brightest star in the heavens. Mars will be scarcely brighter than a third magnitude star, however, as it is now on the far side of its orbit from us. One should be able to pick up this beautiful pair with binoculars, low in the east in the morning twilight on August 23. Mercury will be a brilliant white in color in strong contrast to the ruddy color of the comparatively faint Mars.

Mercury will be at greatest western elongation in the morning sky on August 13, which will be the most favorable position it will have in the morning sky during the entire year. It should be easily found in the morning twilight in the east at that time and for some time before and after that date. Although it will be getting quite low in the sky before sunrise on August 23 it should still be possible to find it and observe its conjunction with Mars on that date. On September 7, Mercury will be in superior conjunction with the sun and it will be too near the sun for the entire month of September for observation. At time of conjunction on September 7 it passes to the evening sky.

Venus is now a magnificent object in the morning sky for several hours before sunrise and will remain so throughout these two months. As always, it outshines all stars and other planets. Jupiter, its closest rival, can never approach it in brightness, although always a brilliant object. Jupiter, also, appears in the east before sunrise in August, higher in the sky than Venus. During these two months it remains in the constellation of Taurus, although by the end of September it is very close to the boundary between Taurus and Gemini, moving steadily eastward among the stars during these months. On September 18 Jupiter is in quadrature and 90 degrees west of the sun. It then rises around midnight and is on the meridian at sunrise. By the end of the month it is rising late in the evening.

Mars is in the eastern morning sky during these two months, too low for easy observation early in August. By the end of September it rises more than two hours before the sun. Its close conjunction with Mercury on August 23 has been mentioned above. During this period Mars passes from Cancer into Leo. It is still far from the earth and not as bright as a third magnitude star. Although more than 240 million miles from the earth on August 1, its (Continued on page 383)

The Laughing, Twinkling Stars

By CLARA BILLINGS

Night came down the evening sky
And wheeled out all the stars.
She unloosed Berenice's Hair;
She set out fiery Mars,
Then carelessly as in great haste
Some asteroids flung after,
While all below and all above
Joined in the nightly laughter.

The School Page

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

BUGS IN SCHOOL

I BEGAN to study bugs in school in the third grade, and have suggested something about these experiences in the special insert in this issue. There were many years in my school experience when we studied nothing but books, and some years in which we studied about insects only from books. I think that the years we studied actual insects in school were the most enjoyable of all.

It was refreshing some time ago to learn that in Japan a group of high school students were studying insects seriously. To prove it they sent me a copy of their "lieflet of the club activity," together with a picture of the group involved. If you are interested in contacting a Japanese school that is interested in insect study drop a line to Masuda Kōtōgakkō Konchuhan, Masuda Upper Secondary School, Shimane Prefecture, Japan. The English used in the "lieflet" is, I am sure, much better than the Japanese we would use in writing a leaflet for Japanese consumption, but there is ample evidence that these Japanese youngsters know more about studying insects and recording their observations than is the case with many of their American contemporaries.

Young entomologists of the Masuda Upper. Secondary School, Shimane Prefecture, Japan

The leaflet gives a map showing where the insects considered are to be found. It gives excellent illustrations, presumably made by the students themselves, and it provides adequate descriptions of the structure, relationships, behavior and importance of the insects. It might be taken as a guide for use by American schools. I have 38 copies of this "lieflet," which I will send to those asking for it. Applications will be numbered as they come to me, and the order of numbering will take into consideration the date on the postmark of the letter. For the first two weeks after the first application is received I will send only one of these leaflets to a community, but if at the end of that time they are not all taken I will send out the others as seems best. If you want this little mimeographed note-book, with an original photograph of the club, for your school file write me immediately. If my supply is not adequate it may be that you could get other copies from the school in Japan. If you or your school are interested in corresponding with these apparently worthy youngsters, here is a good chance.

In these days, when Oriental problems are in the headlines, most of us think in terms of political difficulties. Strangely enough my most personal concern about China involves the fate of two of my early students, a Dr. Ping, who was an entomologist in Shanghai, and a Mr. King, who was a botanist in a Chinese Forestry School. Both were in early classes in botany that I taught at Cornell. Both have remained very personal to me for decades because I remember how seriously they took their work, and how much better they were doing, working with a foreign language, than I could possibly have done.

Maybe these personal comments are inappropriate here, but it does seem that they point up the fact that the study of insects, in school or elsewhere, is not only a local and personal problem but an international problem as well. If we, or the Chinese, or the Japanese, or the Russians, or the Germans can solve a problem regarding the control of some insect pest, that discovery may be more important than all the high level political decisions that anyone can make. Somehow it seems that, eventually, the solution of our world difficulties will lie along the lines the Point Four program has indicated. It will be solved by Fulbright fellows, by exchange professors, or by tourists who have more common sense than many tourists have. It may be solved by correspondence started in your school with youngsters in some foreign land who have a common interest with you, maybe an interest in insects, maybe an interest in one kind of insect.

When I began teaching school in the University of Hawaii in 1930 I had a class of about 100 students of decidedly mixed ancestral history. There were a few Yankees, many Chinese, a few Japanese, many Hawaiians and a great many whose parents obviously had not been concerned about race discrimination. I was almost wholly lost in a flora and fauna totally strange to me. I found it difficult to find examples with regard to which I could be sure my students had had significent experiences. For nearly a week I groped, trying to find a common ground on which to build an understanding. One day I accidentally chose head lice to illustrate a point, and immediately I found an understanding response. Again and again, through the next few weeks, I fell back on head lice to illustrate my point. Head lice are not bugs in the sense of this month's special insert, but they are insects. And it was insects that brought me and those students together. I had never had unpleasant personal experiences with head lice, to be sure, but I knew about them and that helped. I think that any school experience that gives understanding of how men and insects may adjust their differences may be as good citizenship training as one would find in a mastery of the statistics with which some social scientists try to make a case for themselves.

I could write the rest of this page giving suggestions on how to study bugs in school. I could advise you to put into water in the house some sprig of a plant on which there were many aphids, suggesting that all but one be killed and that a count of the aphids to be found on the plant be made at intervals. I could build up a beautiful story based on that experience that would help you understand something of how populations increase, and something of the idea that there are harvestable surpluses that have little bearing on the survival of a species. Instead of doing this I prefer to quote one of those Japanese students who writes about their cicada that is closely related to our harvestfly, or seventeen-year cicada, Hiroshi Kojima writes as follows of their cicada.

"The cicada, *Tibicen bihamatus* Motschulsky. It is found at high mountain (about 900-1000 m) in this district. We can hear the many voices of these cicadas in the wood, but these bodys can not find easily, for these cicadas are at very high places of the trees, and if we go near them, they fly away to the other branches of the trees. We cannot take well with the net. but the life of these imagos of cicadas is only a few days long. Under the trees which have vigorous singing of the cicadas, we can find the poor one which is befor the death in the grass. The Japanese name of this cicada is Koezozemi. Body length 33-35 mm., to the end of wings 50-55 mm. Body colour is blak, the pro and mesonotum have the yellow figures, but W-leter figure in the center of the mesonotum is greenish yellow, and

the pale greenish brown operculum is long as the tongue. The wings is transparence and colourless."

Somehow when I read Hiroshi's account of an insect closely related to one that sings in my trees I join with him in trying to find the "poor one which is befor the death in the grass." His English is involved at times but his meaning is always "transparence," and my experience in reading the "lieflet" written by him and the other members of his Nature club is not "colourless." May you get as much from your reading of his account as did I. I will guarantee that experiences of this sort will make you feel better, and will make you a better more genuine world citizen without in any way decreasing your pride in your own nationality.

AUGUST AND SEPTEMBER SKIES

(Continued from page 381)

distance is slowly decreasing.

Saturn will be the only bright planet to be seen in the early evening sky during these months. It is in Virgo north of Spica and low in the southwest for a few hours after sunset in August. By the end of September it will be so low in the southwest at sunset that it will be difficult to observe. It will still be in Virgo, northeast of Spica.

There will be a partial eclipse of the sun on August 9, which will be visible in the extreme southern part of South America in Chile and the southern part of Argentina, and in the South Pacific, southwest of South America and south of it nearly to the Antarctic regions. The greatest eclipse, which will amount to 37 hundredths of the sun's diameter, will be seen at a point far off the southwest coast of South America at sunrise.

Autumn will begin in the northern hemisphere, and spring in the southern hemisphere, on September 23 at 3:07 A.M., Eastern Standard Time, when the sun will cross the equator into the southern hemisphere.

Hoffmaster Memorial

From 1934 until March 19, 1951, when he passed away suddenly at his office door, Percy J. Hoffmaster served as director of the Michigan Department of Conservation. "Pete," as he was affectionately known to conservationists, made a distinguished contribution to conservation as a far-sighted leader in this field, and as one deeply devoted to preservation of natural resources. A Memorial Fund has now been established to commemorate his contribution, the income from this fund to be used annually to distribute books on conservation to school libraries in Michigan, each book to contain a Percy J. Hoffmaster bookplate.

Bulletins Received

"Housing for Wood Ducks" by Frank C. Bellrose is a 48-page, illustrated bulletin, and Illinois Natural History Survey Circular 45, and is available from the Illinois Natural History Survey, Natural Resources Building, Urbana, Illinois. . . "Monkeys, Their Training, Care and Feeding" by J. Jay Segal is published by Tropical Hobbyland, 1525 N. W. 27th Avenue, Miami 35, Florida. Forty pages, illustrated, $1.00. . ."How to Use Peat Moss" by Alice Very and Edmund R. Brown is a 32-page, illustrated booklet published by Bruce Humphries, 30 Winchester St., Boston, Mass., for 25 cents. . . "Chrysanthemums for the Home and Garden" by E. J. Kraus and Ralph Garren, Jr., is 58-page Station Bulletin 534 of the Oregon Agricultural Experiment Station, Oregon State College, Corvallis, Oregon. . ."Inviting Bird Neighbors" by Mary P. Sherwood and Eva L. Gordon is Volume 46, Number 4 in the Cornell Rural School Leaflet Series. Thirty-two pages, illustrated, it is available free to New Yorkers; 25 cents to others. Department of Rural Education, Cornell University, Ithaca, New York. . . "Washing Our Water: Your Job and Mine" by Helen Beal Woodward is 28-page Public Affairs Pamphlet No. 193 of the Public Affairs Committee, 22 East 38th St., New York 16, N. Y. It discusses the problem of pollution in brief and popular terms. Twenty-five cents. . . "There's Gold in Them Hills near Great Falls, Maryland" by Robert Shostek, 9804 Brunett Ave., Silver Spring, Md., is a brief discussion of gold mining in this area since the War Between the States. Twenty-five cents. . ."Chicago Schools Journal" for January-February, 1953, presents a 48-page Supplement listing Free and Inexpensive Teaching Materials for Science Education by Muriel Beuschlein and James M. Sanders. Ten cents a copy, Chicago Schools Journal, 6800 Stewart Ave., Chicago 21, Illinois.

Canoe Camping

Canoe Camping. By Carle W. Handel. New York. 1953. A. S. Barnes. 192 pages. Illustrated. $3.00.

The subtitle to this practical book is "A Guide to Wilderness Travel." It is calculated to show the reader the problems that he will meet in the wild, with only a canoe and a light pack, and how to meet them. The author is a veteran of wilderness adventure and writes against that background.

Fly Fishing

Still Water Fly Fishing. By T. C. Ivens. New York. 1953. The British Book Centre. 128 pages. Illustrated. $3.25.

This is a guide to fly-fishing in the lakes and reservoirs of England, but should be of interest, because of its practical value, to fly fishermen everywhere. The author has always experimented with tackle and gives the reader the benefit of his mistakes and triumphs.

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Camera Trails

By
EDNA HOFFMAN EVANS

THE STARS have interested a great many people for a great many centuries. Astrologers have prophesied by them, astronomers have studied them, shepherds have watched them, sailors have steered by them, poets have praised them, ordinary people have marveled at and enjoyed them. But, with the exception of a few fortunate individuals with a tremendous lot of specialized equipment, photographers have been stymied by them.

Yes, sir, it is all very well for the horoscope drawer-uppers to feel intimate with the stars. Or for other observers to name them individually and to group them into families or constellations. Shakespeare could see them as "blessed candles of the night" and as "burning tapers of the skies." Longfellow could call them "the forget-me-nots of the angels" and Emerson could pen the advice "hitch your wagon to a star." But still, when it comes to stars, the photographer is left pretty much out in the cold and the darkness.

There is no question about it, the stars are beautiful as they twinkle overhead, pinpoints of light in the soft darkness of the heavens. So far as I know, no artist has caught and recorded on canvas the beauty of the night sky. Only the astronomer with his gigantic telescopes and his specialized cameras has been able to make a pictoral record. But for ordinary photographers like you and me, such pictures are out of the question.

Have you ever tried to take a picture of the full moon? It looks bright enough, surely, and you can take a picture by moonlight, provided you make the exposure long enough. But a picture of the moon, itself, is a disappointing project with the ordinary camera. The moon is a fast mover, believe it or not. Focus on it for only a few minutes and you have not a round image, but an elongated streak. Your eye may not be able to detect so much movement, but your camera lens certainly can. The stars, too, are faint streaks of light—if they show at all—on your negative.

No, the full moon, beautiful as it is, does not make a very good subject for the ordinary camera. But the crescent moon, on the other hand, whether it be old or new, does make an interesting pattern if your exposures are spaced right. A star near by, in close occultation as astronomers say, adds to the interest.

Focus your camera on some bright star first, to make sure you have the sharpest focus possible. Then aim at the moon, making sure that the first image will be so placed on the negative to give room for others to follow. Set the camera on something steady, open the lens for about a one-second exposure, then close it again, wait five minutes and repeat the exposure. You can probably get four or five images on the same negative.

This picture of star trails was made with a Speed Graphic camera. The lens stop was f/8 and the exposure time was seven and one-half hours. The film used had a daylight reading of 50. The finger-like shadow at the right is the silhouette of a giant saguaro cactus in the Arizona desert.

In order to insure complete stability of the camera, it will probably be better to leave the shutter open. Use the lens cap to open and close your lens. As for lens aperture, remember that you want as much light on your film as possible, and at the same time you want as sharp an image as you can get. A lens aperture of f/8 or f/9 should do the trick nicely. Naturally, you should use fairly fast film. It is hard to believe that the moon can move so far in five minutes, or that it can move completely across your picture field in a matter of half an hour. But it does, none the less, and you have the picture to prove it.

Another fascinating astronomical subject within the reach of any photographer is a picture of star trails. Time here is the most important ingredient, and a place where the camera will be undisturbed by either movement or light for a period of several hours. It is best to get away from street lights, car lights, and other disturbances of like nature. A secluded back yard, a roof top, or some place in the country are best.

The camera can be focused on some bright star, as it was in preparation for photographing the moon. Then it should be aimed at the North Star, the shutter opened and left open for a period of at least three or four hours, or even more. The longer the exposure, the more trail each individual star will show. Since you aimed at the North Star, the trails will be circular, revolving around the pole. The Pole Star, itself, will show a small, circular trail since it is a fraction more than a degree away from the exact north celestial pole. If you aim at a point in the sky overhead, the star trails will be straight lines on your negative.

Once you have your camera set up and focused, there is no reason for you to stay around. Your lens and the rotation of the earth will do the job for you. However, there are a few words of caution needed. You should take steps to protect your camera from the dew, particularly the droplets that may form on your lens. These can be prevented by means of a "dew cap" in the form of a cardboard tube fitted around the lens. A two-inch length will give sufficient protection without cutting down on the light that strikes your lens. If you have a lens hood, make an extension for it in order to increase its protection. You may, of course, not care to leave your camera unguarded for hours at a time. Then, too, you want to be sure that no one is going to walk into it in the dark. Such treatment is not good for either camera or picture.

The above examples, moon series and star trails are, alas, about all the cameraman can do without benefit of telescope. Nor is taking a picture through a telescope as simple a matter as taking a microphotograph. There is more involved than the mere attaching of a camera to a telescope.

This being the case, I am quite willing to leave other phases of astronomical photography to professional astronomers, or to specialized astronomical hobbyists.

The Bolsey Set-O-Matic camera is designed to simplify flashy photography by making the necessary adjustments automatically.

Theirs is not a simple task, either. Even when professional astronomers use telescopes geared to move as the stars move, thus making long exposures possible, they have other difficulties to cope with. The earth's atmosphere creates many problems. Wind and turbulence aloft can disturb the atmosphere just as a stone tossed into a mill pond will disturb its smooth transparent surface. Naturally, with this disturbance between the camera and the subject, photography is extremely difficult. Rarely is the air still for long. Thus, with both the motion of the earth and the motion between camera and star, the astronomical photographer's lot is far from a happy or an easy one.

Photography A field. This is the title of a book by Orn ' I. Sprungman, published by the Stac pole Company, Telegraph Press Building, Harrisburg, Pennsylvania. The book, to my way of thinking, is one of the best I have seen in the field of all-around outdoor photography. Its price is $7.50.

The author has been actively engaged in outdoor photography for better than two decades, and his pictures have appeared in numerous magazines. Officially, he is camera editor for the magazine *Sports Afield*.

Perhaps, to begin with, I should mention that several chapters deal specifically with photography of hunting and fishing—sporting photography of specialized appeal. However, a book dealing with outdoor photography from the so-called sporting angle reaches a great many people who would not read a volume devoted to Nature photography exclusively. Any man who can afford a gun, or a fancy rod and reel, can also afford a camera. Get him interested in photography and he may find that stalking his quarry with lens and shutter is much more fascinating than any other kind of chase. Many camera hunters began as gun hunters, and then abandoned bullets in favor of film.

As is stated in the foreword of *Photography Afield*, "Pictures are an important part of the broader pleasures from trips afield. The sportsman who visits woods, field and lake with the camera in place of his shotgun or fishing tackle is a good conservationist, too. There is as much joy in shooting wildlife with a camera for him as there is in destroying it. The game is left there for himself and others to enjoy another day."

Of particular interest to me were the chapters on Bird Photography, on Filming Big Game, and on Filming at Night. The big game chapter has the following sub-headings: Mountain Sheep Without a Telephoto, Filming Bear, Filming a Moose Herd, Daylight Deer, Flashing Wildlife at Night, and Shots in the Dark. In this chapter the author tells how to set strings, flashes, and releases so that animals take their own pictures at night. This is a phase of photography that is more often hinted at than explained.

The second half of the book deals with movie photography, and contains just as many helpful how-to-do-its as the first section on still photography did. All in all, I think the twenty-five chapters, comprising 450 pages and including a multitude of pictures in both black-and-white and color, are well worth anyone's perusal.

(Continued on page 387)

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STALKING THE HURRICANE

(Continued from page 352)

been moving toward land, high level Superforts and Flying Fortresses will be on their way to take over the watch, and to obtain additional radar fixes on the direction and progress of the storm. Although many hurricanes simply veer back out to sea and finally subside in the colder climate of the North Atlantic, each of them is constantly pursued by watcher planes, which radio back the vital information needed by the shore establishments to chart its course and to warn shipping and other planes in its path. Occasionally as many as ten days or two weeks will elapse before the weary pilot of a hurricane-hunting plane can radio in the welcome word: "Scratch Baker. He's through!"

What actually *causes* a hurricane?

Scientists have two theories. One, the "convectional," holds that a large mass of warm air rises in the doldrums of the open Atlantic, east and south of the West Indies. Sea-level air rushes in to replace the vacuum left by the rising warm air. The rotation of the earth now takes a hand, deflecting the slowly moving mass into a counter-clockwise swirl. Presently a vigorous wind system is set up, and, presto, you have a full-blown hurricane roaring on its way. Although it appears to take a generally westward course, the earth is really moving eastward under it.

The second theory is called the "countercurrent." Opposing trade winds, warm and cold, are believed to cause the initial air lift, and the rest of the story is much the same.

Although the composite chart of a season's hurricanes looks like the paths that might be followed in a fox hunt, most of the big storms first head for the West Indies. Some are deflected southward into the Caribbean Sea and die in the mountains of Central America or Mexico, but the majority curve toward the North Atlantic, perhaps striking first at the Bahamas or the Florida peninsula.

No one quite understands why hurricanes take the courses they do, which lends additional importance to three outstanding examples of international accord and cooperation—the weather reporting and forecasting services of the Bahamas, Cuba, and Mexico. In recent years an efficient network of radio communications and weather reporting stations has been established by the governments of these friendly neighbors, and much of the progress we have made in accurate plotting of tropical storms is due to their efforts. The U.S. Navy and Coast Guard assist in servicing and inspecting stations in the more remote islands, and foreign personnel have been trained in weather reporting by the United States.

In addition to manned stations, automatic equipment has been set up on lonely rocks to transmit recordings of barometric pressure, wind direction and velocity direct to receivers in Miami and Key West, Florida. These stations operate from batteries, and need servicing only about once every six months. Although their exposed positions make them extremely vulnerable, they can be easily replaced if they are blown away, and no lives are lost.

Once a hurricane has hurdled the Florida coastline and moved inland a new problem arises. Every man, woman and child throughout the State wants to know the exact timing and direction of movement of the storm. Even if the hurricane is not headed toward their town, or grove, or ranch, Floridians know that the big wind is tricky, and it is likely to change course without any notice.

The standard network of synoptic weather stations is too sparse to give a county-by-county report of a big twister's progress, and besides many of the regular collections of reports and supplementary observations fail because telegraph and power lines are down.

Here is where the amateur radio operator, the well known "ham," comes into his own. They are important, not only because there are a lot of them, well scattered over the Florida peninsula, but also because many have their own emergency power plants.

In 1950 a statewide project to link the amateurs into a hurricane reporting network was launched, and by July, 1951, WARN (Weather Amateur Reporting Network) officially came into being with a drill simulating actual hurricane conditions. In addition to the "hams" the WARN network includes the shortwave stations of the National Park Service, in the Everglades, and the stations operated by the Army Engineers in connection with flood control projects around Lake Okeechobee.

A total of 46 short-wave stations are now prepared to keep close tab on any major storm invading the State, and to take part in disaster relief communications after a hurricane has passed. Through this well-coordinated group of private and government communicators Florida is also probably better prepared to supply civil defense intelligence than is any other State.

In addition to planes, long and short wave radio, and radar, another approach to the hurricane detecting problem is in the process of development by government scientists. About 40 years ago a Dr. Beno Gutenberg, of the California Institute of Technology, wrote a doctor's thesis on "microseisms." These are tiny tremors that continually agitate the needles of sensitive seismographs. It was Dr. Gutenberg's contention that they had something to do with storms at sea. No one paid any particular attention to his findings until World War II, when the armed forces tested his theory with some success.

It is estimated that the eye of a big hurricane lifts two million tons of air from each square mile of water, elevating at the same time the level of the sea a full ten feet. Water is drawn in from all sides, so this means that the hurricane, as it swirls along, adds to the load on every square mile of sea bottom an estimated nine million pounds. Little wonder that the earth rumbles here like a man with an overloaded stomach.

A seismograph station on the coastline, or even a few miles inland, can detect as a matter of routine vibrations of as little as one ten-thousandths of an inch in the earth's upper crust. Consequently a hurricane, adding great and varying pressures to the sea bottom, will set up vibrations that can be transmitted along the floor of the sea and up the continental shelf to the seismographic station, where it is amplified as much as a hundred times!

While this method of stalking hurricanes has not progressed beyond the experimental stage, nor are there enough seismological stations to give proper crossbearings, it may prove to be the quickest method of spotting new-born storms because it does not depend upon ship, plane, or automatic weather station reports.

Radar also is useful, but its range is limited. It is being supplemented by an all-electronic system of storm-tracking using ordinary radio waves. Known as "sferics," it is less accurate than radar but it is still capable of giving considerable advance warning.

But the $64 question is: When will man be able to dissipate or destroy a hurricane? "Seeding" with ice particles and similar methods have been tried. But seeding is primarily intended to *initiate* rain, whereas a hurricane is nothing else but. The Weather Bureau is hopeful that experiments now being carried out by a number of research organizations will eventually prove successful. One attempt in 1947 looked promising when a small hurricane was dissolved, only to reappear a few miles farther north! It may not have been the same one, but new hurricanes are not generally born in cool climates.

Meanwhile the Bureau would like to resume some basic research that was nipped by the Korean war. When ships, planes and money are available it would still like to know the answers to the following questions:

(1) What makes hurricanes form?
(2) What governs their development?
(3) What controls the direction of their motion?

Before any real progress can be made in *destroying* hurricanes, these blanks must be filled in. Meanwhile Florida, Gulf coast, and West Indian communities anxiously await further developments. They feel that most of the responsibility lies with the Federal Government, pointing out that the total cost of the necessary experiments would represent only a fraction of the damage done to government property alone.

If a successful formula for dissolving or diverting a hurricane were discovered, there would be no lack of local backing or financing, provided the latter were not prohibitive. For, while humans may dive for shelter, there is no way of protecting property entirely from wind and wave damage, nor can trees and crops be given tougher fibers to resist the gales.

A counter-attack costing $100,000 a throw, if successful, would be considered a reasonable amount to spend to get rid of a Florida-bound hurricane, where damage from even a small one usually runs far into the millions. The cost in interrupted business and in prospective residents and visitors cannot even be estimated.

Matters are not at a standstill, however, because research and planning is going forward, as well as private experimentation. Anyone looking for a really *big* task might consider taming the hurricane, although before he rolls up his sleeves he should realize he is tackling a force mighty enough to power all the world's machinery for four years! I am speaking of a small, or medium-sized hurricane, not a sky-buster such as that which rolled a good part of the Gulf of Mexico over Galveston, Texas, half a century ago.

Meanwhile better methods of detection and means of warning are being perfected. Mark Twain once said: "Everyone talks about the weather, but no one does anything about it." But Twain died long before the Hurricane Warning Service came into existence, and before intrepid airmen-scientists sallied forth on what must unquestionably be the most rugged, nerve-racking peacetime flying duty in the world. No medals are given to hurricane-hunters. Achievement must be their reward.

Leonard Heads Sierra

Since 1946 Richard M. Leonard has served with distinction as secretary of the Sierra Club and sparkplugged its activities in the conservation field. At the recent organization meeting of the Board of Directors he was elected President. Other officers elected were Harold E. Crowe, vice-president; Lewis F. Clark, secretary; Einar Nilsson, treasurer. David R. Brower resigned from the executive committee to become executive director of the Sierra Club.

Pettingill and Penguins

A winning combination for a future Disney True Life Adventure is promised with the announcement from Carleton College that its distinguished ornithologist, Professor Olin Sewall Pettingill, Jr., will take leave of absence next winter to be in the Falkland Islands to film penguins. Dr. Pettingill, some of whose films have been a part of earlier films in this Disney series, is under contract to Walt Disney on this expedition. He expects, also, to obtain film material for use on his own annual lecture tours.

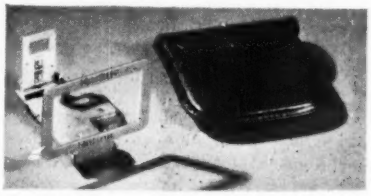
CAMERA TRAILS

(Continued from page 385)

The Bolsey Corporation, 118 East 25th street, New York 10, N. Y., has announced a new camera, the Set-o-matic, that is supposed automatically to compute diaphragm settings and set the correct stops for flash photography in relation to the distance of the camera from the subject.

Also, it provides full latitude in motion for, as the subject moves toward or away from the camera, the diaphragm is automatically corrected while focusing is being done. Further, the camera automatically prevents wasted shots because it stops the focusing at a point at which pictures should not be taken with the film and bulb combination being used.

All these features, I should say, will be of great help to cameramen who are somewhat baffled by the calculations necessary for good flash photography. For further information, write the Bolsey Corporation. They will be happy to answer all queries.



The Kodak retina sports finder that clips on the top of Retina and Retinette cameras, is designed to help the photographer catch fast action and center it properly.

Among the new accessories announced by Eastman is the Kodak retina sports finder, designed to enable photographers to catch fast action and center it properly. The attachment, which clips on the top of a camera, has parallax adjustment to correct camera-to-subject distances from 3½ feet to infinity. It fits Kodak Retina and Kodak Retinette cameras, has a carrying case, and retails for $6.50.

Arranging Flowers

Flower Arrangement at the Crossroads. By Emma H. Cyphers. Boston 20. 1953. Christopher Publishing House. 219 pages. Illustrated. $4.00.

The author stands for common sense and freedom of expression in flower arrangement and for throwing overboard the worthless prejudices and limitations of rules that too often hamper self-expression in this art. Nationally known as a flower arranger, the author is in a position to look at the subject objectively, which she does with good humor and entertaining suggestion. We should say, although we are not even a kindergarten arranger, that this book is for the arranger of flowers who has at least graduated into secondary school status, perhaps even college grade.

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LIFE ON A BLADE OF KELP

(Continued from page 360)

Some of these may suffer from the kelp, but most, and in particular the mussels, usually survive. Green and yellow "breadcrumb" sponges and fleshy compound ascidians are likely to grow among the anchoring processes of the weed. And to add another touch of color, red, yellow and sometimes purple varieties of a small smooth starfish, *Henricia*, crawl in and out of the base.

The round thick stalk of kelp is generally left alone, its surface too curved for most creatures to find anchor. Yet in northern coastal waters of the Atlantic, where the large whelk of the genus *Buccinum* can be found, the kelp stalk is frequently used as a pillar around which to lay its ball of egg capsules.

The blade itself supports a different variety of animals, most of them more vegetative than animate: hydroids, ascidians, bryozoans and others. Among ascidians the golden star *Botryllus* dominates the picture, and sheets of this colonial animal often cover the more shaded areas of the blade—some green, some deep blue or purple, some marbled white and black; but all with star-shaped groups of individuals, each of which produces tadpoles with a typical swimming tail in order to colonize more distant weeds or rocks. Sea mats or bryozoans form smaller, whiter encrustations that look no more like animals than ascidians do; some bryozoan colonies are very flat, almost two-dimensional, others grow outward from their attachment like small bushes in the water.

Hydroids of various kinds also find attachment on the blade. The rosy *Tubularia* often grows where the blade is kinked or broken, forming clusters of what seem animated wind flowers in the water. Like ascidians and bryozoans, the hydroids use the blade only as an anchorage, and all of them find their food by sifting or fishing in the water that flows past. Some hydroids, like *Obelia*, form a network of basal stolons that criss-cross on the blade, from which the individuals grow in an order more like a planted garden's. Even a worm, *Spirorbis*, which lives in a small, coiled, limey tube of its own making, and rears its young within the tube, is usually seen scattered across most of the blade's surface, at least on one side.

All of these take up space, and the space is limited, particularly when you consider that these colonial animals especially can grow in area, but cannot move around. Collisions and competition are inevitable. As a rule the *Spirorbis* worm is there first, its tube fastened by its side to the blade, and tentacles extruded into the surrounding water. Then, a little later in the season, bryozoans and ascidians begin to settle, and if successful start to grow like expanding sheets. If *Spirorbis* is in the way they grow right over it and seal it off from both oxygen and food. While frequently the growing sheets of bryozoans and ascidians come together, each glued by its undersurface to the surface of the blade; but in most such cases the more fleshy, pliable ascidian wins the contest and overgrows the seamat bryozoan, with *Spirorbis* underneath them both.

Apart from these more obvious forms of life, the blade is continually being colonized by many smaller plants and animals, which may or may not have much chance of growth and reproduction. Yet, taken altogether, they comprise a grazing ground for other types, and the surface of a blade usually supports a variety of crawling or gliding creatures. Small limpets and whelks, and young starfishes down to almost microscopic size, browse the surface and find sufficient nourishment. The blade is a world in itself, of competitive, struggling and developing life; and it is one that you can easily discover and study for yourself.

Fence Corners

Fence Corners. By Marel Brown. Nashville, Tennessee. 1952. Broadman Press. 103 pages. $1.50.

This is the third collection of poetry—with a little prose here and there—by this author, whose poems have now and again appeared in *Nature Magazine*. An Atlantan, Mrs. Brown is active in literary circles there and popular as a speaker. In this latest book she has carefully selected poetry that is largely devoted to Nature, and her book will be welcomed by poetry lovers.

Under the Red Sea

Manta. By Hans Hass. Chicago. 1953. Rand McNally and Company. 328 pages. Illustrated by 84 photographs by the author. $4.50.

This is a story of undersea adventure in the dangerous waters of the Red Sea. It is a personal story by the man who explored this under-water world, diving with only swimming trunks and a simple respirator, and armed with a spear for protection and a camera to record what he found. This book has been a best seller in German and British editions and should find favor among armchair adventurers in the United States.

Gadgets etc.

"Hook Sharp" is the name given to a fish hook sharpener, which operates as simply as a pocket pencil sharpener, by its producers, Marlyn Products Company. 201 Cooper Building, Des Moines, Iowa. . . Daltoncraft, Dalton, Massachusetts, has devised a spill-proof, moisture-proof salt and pepper dispenser suited for fishing kit or picnic basket. Sells for a dollar. . ."Fly King" is the name that The Palmer Company, 5 South Franklin St., Chagrin Falls, Ohio, gives to a new fly-destroying trap that screws on the top of any quart mayonnaise or mason throwaway jar. Sells for $1.75. . .Keba Arts, Union, New Jersey, claims its Keba Bird Feeder to be revolutionary. It consists of an inverted glass seed container that empties seed as needed into a shallow trough that supplies four winged perches . . .The outdoor Servicekit produced by General Scientific Equipment Co., 1015 Packard Bldg. Philadelphia 2, Pa., weighs only ten ounces, but is a health, first aid and equipment repair kit for outdoor emergencies. Sells for $6.95. . ."Penetrol" is the trade name given to a new rust remover for various metals including chrome. It also inhibits rust. Made by The Flood Company, Hudson, Ohio. Fifty cents an introductory can. . .The Pak-Quik Stainless Steel Cooking Set introduced by the C. C. Manufacturing Co., 4450 Ravenswood Ave., Chicago 40, Illinois, is designed for outdoors people, trailerites and all who must travel with compact equipment. Standard set is $24.95.

Ailing Plants

Plant Diseases. By Ernst Gram and Anna Weber. Edited and adapted by R. W. G. Dennis. Translated from the Danish by Evelyn Ramsden. New York. 1953. The Philosophical Library. 618 pages. Illustrated. $18.50.

This is a monumental work by two practising plant pathologists and it covers the plant ailments of orchard, nursery and garden crops. The authors have directed their text to the grower, and have made it useful to him in the identification and treatment of plant diseases that he may encounter. There is profuse illustration and these illustrations have been selected to aid in identification of the infection or infestation. Both authors have long been associated with the famous experimental station at Lyngby, Denmark. The British editor is also a plant pathologist at the Royal Botanic Gardens in Kew. This is a valuable reference work for any agricultural library.

Science

The Way of Science, Its Growth and Method. By John Somerville. New York. 1953. Henry Schuman. 172 pages. Illustrated by Dwinnel Grant. $2.50.

In this book the authors seek to provide the student of science with four tools to the full understanding of science. These are the methods basic to all science; the historical growth of science; the relation between natural and social science; the connection between sciences and arts. This should be a most useful book and could very well be introduced to the prospective science student as a means to whetting his appetite for this study. At least it will arm him for a better grasp of the subject.

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UNDER THE MICROSCOPE

By JULIAN D. CORRINGTON

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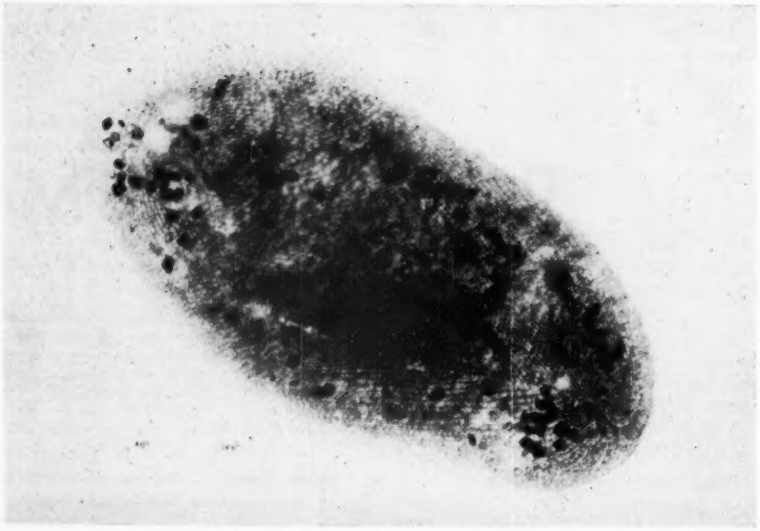
"My nuclei stained,
And now they're reducing my fleece!"



Paramecium, photographed from slide courtesy Ward's Natural Science Establishment

THE portrait of *Paramecium* that confronts you here does not bear a very close resemblance to the usual likeness of that celebrated denizen of the Microcosmos. Yet it reveals certain details not otherwise seen, and is part of the means of getting acquainted with this animal that we are discussing from time to time in these columns.

In the more extensive slide catalogs you may find this item listed as "Paramecium, pellicle stain," and you will pay rather more for it than for routine slides, since the time and labor involved are a bit greater and orders apt to be scanty. There are a number of ways of securing the desired results, and we shall mention some after describing the structures involved.

Certain of the protozoa have only the thinnest and flimsiest of coverings for their cell body. In amoeba, in fact, there was long doubt as to the existence of a separate membrane of any sort. In such cases the body is likely to have no permanent shape (*protean*, readily assuming different shapes), whereas in many protozoa there is specialization of the ectoplasm, producing a *pellicle*. This may be a structureless membrane, or it may show spiral striations or a series of ridges and grooves in connection with the distribution of cilia. In paramecium, these locomotor hairs arise from basal bodies deep within the ectoplasm, and pass through the pellicle, each bounded by a hexagonal raised area. The total effect of a surface view when these hexagonal ridges are stained is that of many fine striations running in spiral patterns, reminding one vaguely of a fingerprint. The network of hexagons, with cilia in their centers and trichocysts from the deep ectoplasm opening on their ridges, is invisible without special treatment.

The animals may be fixed wet or dry. If a typical wet fixation, as Schaudinn's, is used, the surface markings may be stained. Bresslau used cyanochin, a mixture of 3 parts of a saturated solution of china blue with 1 part of a saturated solution of cyanosin. The markings may also be demonstrated with silver nitrate, the action being impregnation, not staining. For example, protargol, alone or mixed with silver nitrate, can be reduced with hydroquinone chemically, as in the photographic process. Metallic silver is deposited on the ridges, which stand out in contrast to the interlinear spaces.

In the dry technique, generally preferred, the markings may also be either stained or impregnated. Coles employed nigrosin in a saturated aqueous solution. Place a drop of paramecium culture on a slide, along with a drop of the stain; mix thoroughly, then spread out to a thin film with a loop, needle, or toothpick. Let dry in the air (fixation by rapid drying; hence film must be thin, as in blood smears). Examine under the microscope and, if successfully stained, dry completely and mount in balsam.

For impregnation, Klein spread a thin film of culture, drying in the air as just described, but without the stain. Stand the slide for ten minutes in a 2% aqueous solution of silver nitrate, rinse thoroughly in distilled water and then place in a vessel of distilled water (preferably a white porcelain dish) in strong sunlight. This reduces the silver as in another portion of the photographic procedure, but is slow, requiring some six hours. Test by examining from time to time under the microscope. When the silvered lines are sharp and dark, stop the action by drying the slide, then mounting.

SCIENCE SHOPS
5. Flatters & Garnett, Ltd.

HOW would you feel if you lost forty thousand prepared microscope slides in a single night? We have not asked this question of Wilfred J. Garnett, managing director of the celebrated British firm of Flatters & Garnett, Ltd., but there is abundant evidence of the spirited way in which he and other owners and employees responded to the crushing blow of a disastrous fire, the second such calamity in the space of twelve years. They went on promptly with unflagging determination and energy, observed their fiftieth year in 1951, and continue as one of the world's great science shops.

No American firm could show a more romantic history. Instead of the quiet and orderly story we expect about the founders of an English house, we are met instead with a combination of Horatio Alger and Joseph Conrad. The senior member was Abraham Flatters, born in 1848 at West Stockwith near Gainsborough, Lincolnshire; one of a large family of children. The father was a farm laborer and the home only a small cottage with an earthen floor. Young Abraham can have had little formal education for he was sent to work in Manchester early in his youth, first at a dye works, then for many years as a lamplighter at a railway depot. At the age of 36 he attended some special lectures in elementary zoology for working men. So great was his interest and so lean his resources during these years that he cut his own glass slides for mounting specimens from the broken glass of railway coach windows, and copied out by hand, night after night at the free library, the complete text of Gray's *Manual of Botany*, together with tracings of each of the 695 illustrations! His zeal earned appointment in 1892 as head of a biological station in Jersey, where for three years he worked to perfect his knowledge.

Upon returning to Manchester in 1895, Flatters opened up his own business, making microscope slides and lantern slides. Soon he was appointed lecturer in microtechnique at the Manchester Technical College, a post he held for 32 years. In 1905 he published his *Methods in Microscopical Research*. Many of his sections, stained and mounted fifty or more years ago, are still as bright and clear today as when they were made. Other publications followed, and election as Vice-President of the Manchester Microscopical Society, which he had joined earlier, and where he met Charles Garnett.

After the fire and, below, today.

Born in 1843 at Latchford, near Warrington, the youngest son of a blacksmith and wheelwright, Charles Garnett was brought up in strict fashion by an older sister, the mother dying when Charles was young. The family were members of the Society of Friends, and the children attended the Quaker Boarding School at Ackworth, with its single day per year holiday, its hard discipline, but its excellent educational standards. Here Nature study became the life interest of Charles.

Apprenticed to a grocer, Charles worked until he was 21, then suddenly kicked over the traces and announced, to the utter consternation of his family, that he was sailing at once for Australia. So, in 1863, the long voyage by sailing ship began, the young man arriving in New Zealand with thirty shillings in his pocket. But work was plentiful and Charles strove diligently for ten years, then returned to Manchester with a bank account, and opened a fine restaurant. Joining the microscopical society in 1887, he met Flatters and finally the two, with John B. Garnett, son of Charles, organized the firm uniting the two families in 1901.

John B. Garnett, born in 1877 in Manchester, was the eldest son and was, like his father, educated at Ackworth. In 1892 he was apprenticed to a chemical firm, passed his pharmaceutical examinations later, and then worked for other chemists. About 1897 he attended Abraham Flatters' class in microtechnique, extending the informal training the older man had given him during boyhood school vacations.

As the new business opened, John was in charge of the Chemist's Shop at 46, Deansgate, while Flatters ran his slide business at his old home, 16, Church Road, Longsight. This arrangement worked for a while, but it was found that the operation of two separate establishments was too expensive, the chemical part not paying its way, so they were combined at 32, Dover Street, near the University. There arose serious disagreements that resulted in Flatters leaving the firm in 1909 and setting up a rival business that failed four years later. The self-made man who had pulled himself up through such tremendous efforts was, alas, temperamental and devoid of business sense. He continued to make slides for many years and died in 1929 at the age of 81.

A first cousin of John Garnett's, Henry Garnett, also a pharmaceutical chemist, joined the firm in 1906. He had been educated at Newtown School at Waterford, in Ireland, where his father was Headmaster, and proved to be a brilliant student, winning numerous medals and developing a love for natural history.

In 1913, then, we find the young science shop entirely in the hands of the Garnett family, Flatters having been bought out at his own request. There were 12 on the staff, less than one-fifth of today's roster, mostly engaged in making slides, but also manufacturing a few accessories. The opportunity arrived in this year to lease the property at 309, Oxford Road, Manchester 13, which has been the address of the Company ever since. Purchase of these premises followed in 1919. The building is directly opposite the University, an excellent location for a specialized

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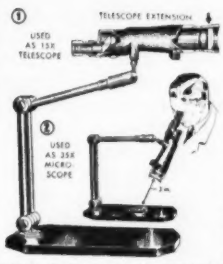

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business dealing in materials used in the natural sciences.

The firm survived the first world war with considerable difficulty, but it was in these lean years that their famous chemical specialties were developed. The first of these was *Mersol*, a synthetic immersion oil for microscope objectives, followed by *Euparal*, a synthetic mounting medium that has enjoyed immense and worldwide popularity. Flatters & Garnett manufactured this complex substance for Professor Gilson, of Louvain University in Belgium, and his royalties contributed to the rebuilding and restocking of the university's library, destroyed in the war. Then came *Murrayite*, a sealing compound invented by Dr. Hay Murray, then at the Liverpool Museum. It is a celebrated water- and alcohol-proof cement, used for sealing museum jars and for ringing microslides.

Flatters & Garnett came into possession of a machine shop through default of a workman to whom they had advanced funds. This angle of the business was restricted to repair jobs at first, but went into manufacturing later. Prosperity, a relative stranger thus far, began to patronize the company. In 1921 Charles Garnett died at the age of 78. He had been Chairman since the foundation, and his counsel was a potent factor, but now the establishment was firmly on its feet. The premises were expanded by further lease in 1924 and three years later the workshop was moved to Dover Place, in rear of the Oxford Street buildings. Here was begun the manufacture of clinostats, auxanometers, microprojectors, dissecting microscopes, and other items of scientific equipment. The *No. 1 Precision Microprojector* was designed by John Garnett, has been changed but little since, and ranks today as one of the finest available instruments in this field. The era closed with the tragic death of Henry Garnett, Chairman since 1921, in a bus accident in 1931. He was then 63.

Wynnstay House, a large Victorian mansion at Fallowfield, about two miles distant, was acquired in 1932, and the Micro-slide, Specimen, Photographic, and Chemical Departments were transferred to this new home, destined to bring both prosperity and disaster. A large workshop was added in rear of the main building in 1935, and here the instrument works developed to new heights.

John Garnett became Chairman upon the death of Henry, and in 1936 his son, Wilfred J. Garnett, having taken his M.Sc. in Botany at Manchester University, joined the firm as biologist. A new department was set up in 1937 to handle the growing business in skeletons and dissections. On the morning of Sunday, Dec. 20, 1937, fire of unknown origin broke out in Wynnstay House, completely destroying the attics, Micro-slide, and Chemical Departments. The rear part of the building was saved, including most of the specimens and even some live frogs and snakes, a news item that greatly interested the daily press. Through some quirk that seems utterly impossible, the stocks of microslides were saved. They were found preserved in their boxes on the shelves, although the fronts of the boxes had been burnt off. For weeks staff members worked like Trojans in a cold cellar, cleaning and labeling more than four thousand bottles of specimens that had been covered with soot.

Then came the second world war, again a most difficult period. Wilfred Garnett was transferred to the head office in Oxford Road to become joint managing director with his father, and a modernization and reorganization was effected. In 1947 a Department of Entomology was added, in 1948 the firm took space at the British Industries Fair, but on Sept. 17, 1949, the second great disaster struck. Again it was a Sunday morning, and again a fire of undetermined origin that swept through Wynnstay House, but this time the effects were even more severe. The entire collection of some 40,000 microslides was completely destroyed. Also lost were the equipment and specimens of the preserved materials, dissection, and skeleton departments. Although a staggering blow, the staff was at work Monday morning, commencing the long task of clearing rubble, salvaging stock, and preparation of new stocks. Half the members of the Micro-slide Department were again at work making slide mounts in temporary quarters in the workshop within three days. The astounding total of more than 10,000 slides was made in less than one month after the fire.

To keep their friends and customers informed, *Progress Reports* were released from time to time. To date, 16 of these four-page leaflets have appeared. In 1950 the industrial microprojector *Mikrops* was released, and projections of living organisms drew crowds at the Fair. More space was purchased at Oxford Road, and today the firm carries on, bigger and better than ever. Their semicentennial booklet, *50 Years' Service to Microscopy*, recounts some amusing items. Misspellings of the firm names were not uncommon, but the height of the ridiculous in this regard was reached with the arrival of a letter from abroad addressed to "Feathers and Gannet, London."

Some products of the company not previously mentioned are microtomes, lens stands, turntables, and microscope lamps, including their well-known *Pointolight*; collecting apparatus of every sort; a new synthetic *Neutral Mountant* to replace Canada balsam in slide technique; stains and reagents; a collection of over 10,000 lantern slides of natural history subjects, now being made as 2 x 2 glass slides; and living and preserved plants and animals. In addition, the establishment handles a large number of items made by others, so that their service to schools and colleges may be complete. Instead of a single large catalog, Flatters & Garnett issue sectional catalogs periodically. A new edition of *Microscopical Preparations* is expected soon.

NEW AMATEUR MICROSCOPE

RECENTLY we have made the acquaintance, by correspondence, of the Edmund Scientific Corporation, of 101 E. Gloucester Pike, Barrington, N. J., N. W. Edmund, President, and have been amazed at the extent and variety of their stock. Starting with sales of seconds of lenses, 1944 launched the young company into war surplus business. This grew so rapidly that today they are leaders in this extensive field. They seem to carry everything that would in any way interest the amateur or the experimental user of optical instruments and their accessories and component parts, as mountings, lenses, prisms and filters. By means of their equipment items plus well-written instructions, usually picturized, the amateur optical scientist can assemble and build his own prism binoculars, telescope, and many other items. Since so many of their stock items are war surplus, prices are consequently low. Many instruments are imported from Japan. Various pamphlets and how-to-do-it publications by Mr. Edmund we found well executed and informational.

Our first inquiry had to do with microscopes. They import several models, but the one they sent us to play with is a Japanese instrument styled the *Edmund 300X*, and this proved to be an excellent product indeed. It looks just like any standard laboratory microscope save in size, being ten inches high. The horseshoe base is one casting, the Zeiss-style arm another, and the stage a third, all in crackle finish. The tube and triple revolving nosepiece are black satin finish, the optics bright aluminum or chromium. There is an inclination joint, plane mirror in swivel fork, two stage clips, achromatic objectives 10, 20, and 30X, conspicuously marked, rack-and-pinion focusing by coarse adjustment heads, and a 10X eyepiece. All optics may be unscrewed for cleaning. Final magnifications are 100, 200, and 300X.

This instrument sells for $14.95 postpaid, in a wooden box with a sliding door, and we can well believe the firm's statement that "if made in U.S.A., would have to sell for about $50.00 to $75.00." We have tried out this clever microscope on a variety of histological and botanical preparations, and find the definition good, the image clear and flat, especially so in the high-power (30X) objective. It is not meant to imply that its performance could be compared to a standard microscope costing six to ten times more, but it is a lot of microscope for the money and definitely the best buy in its price class that we have seen.

BLOOD doesn't grow on TREES

Neither can you dig it up out of a mine in the ground. Human blood is manufactured in only one place—the human body.

Vast quantities of blood are needed—urgently needed—to help save the lives of the men wounded in combat, and of the hurt and sick in hospitals at home. Blood is also needed to produce gamma globulin, the new serum that promises to do much to protect children from polio and measles.

Only you can supply this blood.

You can do it easily, quickly, and with no more hurt than a tiny pin-prick you hardly notice. Furthermore, you can do it again in a few months without danger.

Isn't it worthwhile to take a few minutes time to save a human life? Give blood—keep on giving blood. How? Call your Red Cross, Armed Forces or Community Blood Donor Center today!

GIVE BLOOD

...give it again and again

NATIONAL BLOOD PROGRAM

He Was the Last Man

Pfc. Hector A. Cafferata Jr.
USMCR
Medal of Honor

IT WAS DURING the Chosin reservoir fighting. Against F Company's hill position, Reds were attacking in regimental strength. The last of Private Cafferata's fire team-mates had just become a casualty, leaving a gap in the defense line. If the enemy could exploit it, they could smash the entire perimeter.

Exposing himself to devastating fire, Private Cafferata maneuvered along the line. Alone, he killed fifteen Chinese, routed the rest, and held till reinforcements plugged the hole.

The Reds hit again. A grenade fell into a gully full of wounded. Private Cafferata hurled it back, saving the men but suffering severe wounds. Ignoring intense pain, he still fought on until a sniper got him.

"If we really want to protect ourselves from the Commies," says Private Cafferata, now retired because of wounds, "we've got to go all out. And one thing all of us at home can do—*should do*—is invest in our country's Defense Bonds. Sure, Bonds are our personal savings for a rainy day. But they're more—they're muscle behind our G.I.s' bayonets, too!"

* * *

Now E Bonds pay 3%! Now, improved Series E Bonds start paying interest after 6 months. And average 3% interest, compounded semiannually when held to maturity. Also, all *maturing* E Bonds automatically *go on* earning —at the new rate—for 10 *more* years. Today, start investing in Series E Bonds through the Payroll Savings Plan; you can sign up to save as little as $2.00 a payday if you wish.

Peace is for the strong! For peace and prosperity save with U. S. Defense Bonds!

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